Vol. 10, No. 3
February 15, 1985

Energy Research Abstracts

Abstracts 4147-6252

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription (use PB85-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic (North America) or $28.00 for foreign (outside North America); a single issue is $7.00 or $14.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB85-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers; a single issue is $7.00 and $14.00, respectively.

***Current Energy Patents (CEP)*–PB85-902800**

Devoted to international patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB85-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB85-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB85-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB85-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic (North America) and $80.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB85-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB85-900700**

Covers worldwide information on the technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB85-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB85-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB85-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB85-900600**

Covers worldwide information on all aspects of biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB85-914700**

Covers information on the exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*–(PB85-900500)**

Covers all aspects of heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB85-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB85-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB85-913500**

Covers the safety aspects of accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB85-902900**

Covers the management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB85-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB85-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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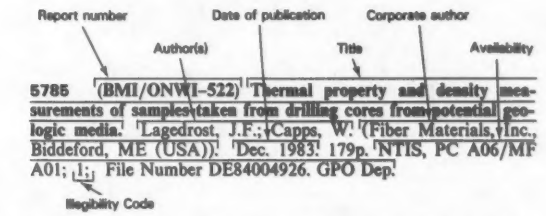
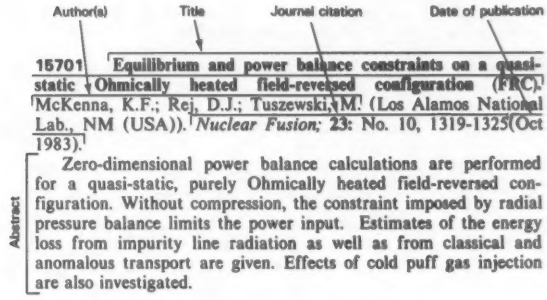
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Illegibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830 **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-522 9:5785 NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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CEA Centre d'Etudes de Saclay
GIF-sur Yvette Cedex, France

Fachinformationszentrum
Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
Dublin, Ireland

IEA Coal Research
Technical Information Service
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National Library of Medicine
Bethesda, MD

Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

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ENERGY RESEARCH ABSTRACTS

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REFER ALSO TO CITATION(S) 0100004243, 4265

4147 **(EUR—7633-DE-EN-FR-IT) Chemical and physical valorization of coal.** (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1982. 167p. (In several languages). (CONF-8011177—). Commission of the European Communities, Luxembourg.

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (24 Nov 1980).

The report contains 17 separate papers which mainly deal with fundamental studies to ascertain the suitability of coals and coal products for valorization purposes. These include chemical composition of the starting material and final products following diverse thermochemical or extraction procedures, influence of temperature, pressure and other process parameters on composition and structure of products, improvement of analytical methods etc. In some cases model components are used for comparison purposes. Further themes are oriented towards application eg. utilization of active carbon for waste water treatment, manufacture of electrode coke and a new formed coke process.

0104 Processing

REFER ALSO TO CITATION(S) 0104004201, 4201, 4212, 6237, 6238, 6239

4148 **(AD-A—953431/4) Determination of the commercial yields of gas, tar, benzol and ammonia of a coal utilizing a full scale coke oven. Quantity of the liberated by-products during the course of the carbonization.** (General Staff, Washington, DC (USA). Intelligence Div.). 1 Oct 1946. 31p. (SC—171). NTIS, PC A03/MF A01.

4149 **(BMFT-FB-T—84-148) Development of catalysts and process for the preparation of long-chain aliphates from synthesis gas.** Moraw, K.; Frohning, C.D. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 127p. (In German). NTIS (US Sales Only), MF A01. File Number DE84752274.

The aim of the research was to shift the product range of the Fischer-Tropsch-Synthesis as far as possible towards long-chain hydrocarbons. The results achieved show that by the development of special catalysts and the use of appropriate process conditions, it is possible to influence the product composition in the FT synthesis so that mainly long-chain hydrocarbons are produced. With two types of catalysts - strongly alkalised iron catalysts and catalysts with SMSI-character - a combination of high selectivity and good activity was achieved. Space-time yields of 20 - 29 g of wax per l catalyst x h were attained. This is a definite improvement on the current state of technology. A further improvement of the wax yield has been achieved with the recirculation of product formed during the reaction which is liquid under reaction conditions (Rieselfilm). However, the work on this development has not yet been concluded.

4150 **(DOE/ET/10069—T96) EDS coal liquefaction process development: Phase V, interim report. Volume IV. EDS bottoms combustion evaluation and burner development. EDS Hybrid Boiler Development Program.** Lexa, G.F.; Towle, D.P.; Smith, D.A. (Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.). Feb 1984. Contract FC05-77ET10069. 164p. (FE—2893-135). NTIS (US Sales Only), PC A08/MF A01; 1; GPO Dep. File Number DE85003199.

This interim report documents work carried out by Combustion Engineering, Inc. under a contract to Exxon Research and Engineering Company and was prepared by Combustion Engineering, Inc. This report is the fourth of four by Combustion Engineering, Inc. on the development phase of the Hybrid Boiler program. This volume documents the results of commercial scale firing tests performed on the solid vacuum bottoms residue from the EDS Coal Liquefaction Process.

4151 **(DOE/MC/19301—5) Coal Gasification Research Studies. Project 61063 quarterly report, August 20-November 19, 1983.** (Institute of Gas Technology, Chicago, IL (USA)). Nov 1984. Contract AC21-82MC19301. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002509.

The Coal Gasification Research Studies program consists of three tasks: (1) coal ash behavior studies; (2) high-pressure fluidization studies; and (3) high-temperature fluidization studies. During this quarter, four gasification runs were made in the 2-inch fluidized-bed gasifier at 1800°F and 2000°F using gas mixtures of both high (5%) and low (0.2%) oxygen content. The carbon conversion of these runs ranged from 25 to 70%. Rounded ash particles typical of ash agglomerates were observed in the reactor residue of the high-oxygen (5%) run at 1800°F and the low-oxygen (0.32%) run at 2000°F. The low-oxygen runs at 1800°F did not produce these rounded agglomerates. In the high-pressure fluidization studies, a series of tests was conducted this quarter to determine the best gas distributor configuration (number of orifices and orifice diameter) to use for the bubble characteristics study. In view of the signal quality and bubble frequency results, the best gas distributor configuration was determined to be a 10-orifice distributor with 3/16-inch-diameter orifices distributed in three concentric rings. In the high-temperature fluidization studies, two heat-up tests at 900° and 1500°F were conducted this quarter in the 6-inch-diameter, Schedule 10, Type 316 stainless steel high-temperature reactor. 2 references, 17 figures, 4 tables.

4152 **(DOE/MC/19301—6) Coal Gasification Research Studies. Project No. 61063 quarterly report, November 20, 1983-February 19, 1984.** (Institute of Gas Technology, Chicago, IL (USA)). Nov 1984. Contract AC21-82MC19301. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003528.

The Coal Gasification Research Studies program consists of three tasks: (1) coal ash behavior studies; (2) high-pressure fluidization studies; and (3) high-temperature fluidization studies. Five fluidized-bed gasification runs were conducted in the 2-inch ID gasifier using char from Pittsburgh seam coal. The first two runs were made with char devolatilized at 1700°F. The char used for the other three was devolatilized at 1400°F to prevent the formation of metallic iron. Complete analysis of the first two runs has been completed and is presented in this report. In the high-pressure gasification studies the debugging of the data analysis computer program was completed and a series of experimental runs was conducted at ambient temperature and pressure this quarter. Ottawa sand was used as the bed material for these runs. Data were obtained at fluidizing gas velocities of between 1.5 and 2.7 times the minimum fluidization velocity at three radial positions in the bed. The results of

these runs showed that the bubble frequency increased with increasing height above the gas distributor except at low velocities where incomplete fluidization occurs and that bubble frequency at the point closest to the wall was lower than at the center of the bed. The local bubble flow rate, defined as the product of the bubble frequency and average bubble pierced-length, at three radial positions in the bed was determined for two excess fluidization velocities. In general, increasing the excess fluidizing gas velocity increases the bubble flow rate. This suggests that the extra fluidizing gas added to the bed was preferentially distributed to the bubble phase. Also, the results indicate that the local bubble flow rate was lowest near the wall of the column. 6 references, 17 figures, 3 tables.

4153 (DOE/METC—84-10) **Proceedings of the systems simulation symposium of fossil fuel conversion processes.** Graham, L.E. (USDOE Morgantown Energy Technology Center, WV). Jun 1984. 374p. (CONF-831239—). NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE84003079.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The systems simulation symposium of fossil fuel conversion processes was sponsored by the US Department of Energy, Office of Fossil Energy and Morgantown Energy Technology Center. It was held at the Sheraton Lakeview, Morgantown, West Virginia, December 6-8, 1983. Twenty-nine papers in the proceedings have been entered individually into EDB and ERA. (LTN)

4154 (DOE/METC—84-10, pp 5-18) **Process simulation activities at METC.** Bajura, R.A. (Morgantown Energy Technology Center, WV). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The Advanced System for Process Engineering (ASPEN) is a state-of-the-art computer program designed to simulate fossil fuel conversion or utilization processes. The code was developed by the Massachusetts Institute of Technology under Untied States Department of Energy sponsorship. This paper describes several of the ASPEN simulations conducted at Morgantown Energy Technology Center (METC) and also overviews the external ASPEN simulation contracts managed at METC. Since ASPEN was installed on the METC VAX 11/780 computer system in 1980, the code has been used for several in-house simulation studies. METC has also initiated several external contracts to develop ASPEN simulations of processes in METC's technical program areas. The ASPEN models and simulations developed by or for METC have played an important role in identifying the developmental issues in emerging fossil energy technologies. The simulations have shown themselves to be important tools for studying process sensitivities, analyzing and systematizing large quantities of process data, predicting the performance of proposed fossil energy processes, assessing the environmental impact of advanced processes, and monitoring the environmental performance of existing projects. 8 references, 2 figures.

4155 (DOE/METC—84-10, pp 36-45) **Analysis of high-temperature, high-pressure filtering systems with sequential element backflushing.** Geller, E.W. (Flow Industries, Inc., Kent, WA). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—). Contract AC21-80ET17093.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

One method of cleaning a high-temperature, high-pressure (HTHP) gas stream is to connect filter elements between common dirty-side and clean-side plenums in a pressurized vessel through which the stream is forced. Sequential as opposed to simultaneous backflush cleaning of the elements is used and, as a result, analysis of the pressure drop is not trivial. Such an analysis has been made for two Westinghouse-developed HTHP systems, one based upon a ceramic cross flow filter (CXF) and the second on a granular bed filter (GBF). The CXF system is characterized by a very short duration backflush pulse that contributes little to the vessel outflow. This fact allows calculation of the pressure drop versus fractional cycle time without knowledge of many of the defining characteristics, such as the inlet dust loading and the dust cake resistance coefficient. These characteristics are needed only for obtaining the cycle time. The GBF system is characterized by a long duration backflush pulse that may contribute significantly to the gas flow through the vessel. As a result, the input requirements for calculating the average pressure drop are more extensive than for the CXF case. 5 references.

4156 (DOE/METC—84-10, pp 46-56) **ASPEN modeling of the tri-state indirect liquefaction process.** Begovich, J.M.; Clinton, J.H.; Johnson, P.J.; Barker, R.E. (Oak Ridge National Lab., TN; International Minerals and Chemicals, Terre Haute, IN). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The ASPEN process simulator has been used to model an indirect liquefaction flowsheet patterned after that of the Tri-State project. This flowsheet uses Lurgi moving-bed gasification with synthesis gas conversion to methanol followed by further processing to gasoline using the Mobil MTG process. Models developed in this study include the following: Lurgi gasifier, Texaco gasifier, synthesis gas cooling, Rectisol, methanol synthesis, methanol-to-gasoline, CO-shift, methanation, and naphtha hydrotreating. These models have been successfully developed in modular form so that they can be used to simulate a number of different flowsheets or process alternatives. Simulations of the Tri-State flowsheet have been made using two different coal feed rates and two types of feed coal. The overall simulation model was adjusted to match the Tri-State flowsheet values for methanol, LPG, isobutane, and gasoline. As a result of this adjustment, the MTG reactor yield structure necessary to match the flowsheet product rates was determined. The models were exercised at different flow rates and were unaffected by such changes, demonstrating their range of operability. The use of Illinois No. 6 coal, with its lower ash content, resulted in slightly higher production rates for each of the products as compared to use of the Kentucky coal. 11 references, 3 figures, 6 tables.

4157 (DOE/METC—84-10, pp 150-158) **Model of an entrained-flow gasifier.** McMichael, W.J.; Cleland, J.G. (Research Triangle Inst., Research Triangle Park, NC). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

A simplified model of the Koppers-Totzek entrained-flow gasifier is presented in this paper. The model divides the gasifier into four sections: combustion, gasification, quenching, and gas cooling zones. Each of these zones can influence carbon conversion and useful gas ($CO + H_2$) yield. The development of the computational procedure to calculate these two quantities for each zone is briefly described. Computed results on the behavior of 5 bituminous coals in the K-T gasifier are presented. RTI's approach in developing a model of the K-T gasifier was to use a combination of theoretical and empirical techniques and to retain just enough detail that the model would yield reasonable qualitative as well as quantitative results. 5 references, 7 figures, 2 tables.

4158 (DOE/METC—84-10, pp 169-178) **First-order environmental simulation of the GPGP crude gas quench, cooling, and gas liquor flash.** Noblett, J.G. Jr.; Lowell, P.S.; Cheng, D.H.; French, W.E. (P.S. Lowell and Co., Inc., Austin, TX; EG and G WASC, Inc., Morgantown, WV; US Dept. of Energy, Morgantown, WV). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The work described here was part of a program supported by the Morgantown Energy Technology Center. The objective was to develop first-order computational methods for describing the distribution of potential pollutants in a gasification plant. The gasifier quench, cooling, and gas liquor flash portions of the ANR Great Plains Gasification Project (GPGP) was used as an example. These portions of the plant contain a series of coolers followed by vapor-liquid separators. The condensed liquids are removed from the cooling train, combined, and flashed at ambient pressure. The gasifier outlet was approximated with 20 compounds ranging from hy-

drogen through o-cresol to n-decane. A Peng-Robinson equation of state was used to describe the vapor and organic liquid phases. Lowell and Company's aqueous chemical and physical properties (ACAPP) routine was used to describe the aqueous phase. The ACAPP program describes strong and weak electrolytes, dissolved organic, and other neutral compounds. The distribution of selected oxygenated hydrocarbons and organic nitrogen and sulfur compounds was calculated for several different operating conditions. Estimates of the distribution of other compounds may be made by comparing their properties to those of the example compounds. The major factors are boiling point, aqueous solubility, and electrolyte properties. 2 references, 1 figure, 6 tables.

4159 (DOE/METC—84-10, pp 179-185) **Zero-order trace element distribution modeling.** Thomas, W.C.; Page, G.C. (Radian Corp., Austin, TX). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The release of trace elements from coal conversion facilities is receiving increased attention from government agencies and environmental groups. In response to this interest, Radian has developed a zero-order, microcomputer based model for estimating the distribution of trace elements in coal gasification facilities. The model uses a module approach wherein trace element balances are calculated around individual process units or blocks of process units. Flexibility is built into the model. Each module is user-defineable, allowing best use of available trace element information for the facility of interest. Variability in coal trace element concentrations is easily examined. Under contract to METC, Radian developed zero-order trace element distributions for the GPGA coal gasification facility being constructed near Beulah, ND. The results of that effort are presented in this paper. Three of the major conclusions from Radian's work are: (1) gasifier ash retains most of the coal trace elements, but by itself is not expected to produce a hazardous leachate; (2) brine derived from treating, concentrating and incinerating process wastewaters may be a hazardous waste; and (3) co-disposal of gasifier ash and incinerated brine may produce a hazardous waste. The major concern appears to be high levels of arsenic. 6 references, 1 figure, 4 tables.

4160 (DOE/METC—84-10, pp 210-217) **Evaluation and enhancement of the ASPEN physical property database.** Millman, M.C.; Stern, S.S.; Schwint, K.J.; Dweck, J.S. (Halcon Computer Tech., New York, NY; Scientific Design Co., New York, NY; JSD Consultants Inc., Denver, CO). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

As part of a DOE contract to prepare a simulation model for the Great Plains plant, the physical property data bases within ASPEN were checked for the thirty five components used in the simulation. In this regard, SAS(1) procedures were developed so that unary and temperature dependent properties could be checked. In addition, in order to simulate the vapor liquid equilibrium, the Peng-Robinson correlation modified for water interaction was used. Data regression runs were made and parameters were developed which gave reasonable predictability for the phases in equilibrium. As part of the DOE-METC project to simulate the Great Plains Coal Gasification Plant on ASPEN it was decided to screen the unary and temperature dependent physical properties data values in ASPEN for those compounds required to model the various sections of the plant against a recognized, high quality data bank now being generated at Penn State University under Project 801 of DIPPR. It has been found: (1) The ASPEN data bank is for the most part reliable, its main problem being lack of documentation; (2) some missing values and discrepancies in the unary properties have been identified; and (3) the two temperature dependent property predictions, heat of vaporization of benzene, and vapor pressure of ethylene glycol, were deemed to be sufficiently lower in quality in ASPEN than in DIPPR to warrant further study.

4161 (DOE/METC—84-10, pp 218-228) **Unified data set for simulating analyzing and designing a fuel production process.** Fan, L.T.; Shieh, J.H.; Graham, T.W. (Kansas State Univ., Manhattan, KS). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

A procedure has been developed for systematically estimating and predicting the physical properties and thermodynamic functions of material species involved in fuel processing. A comprehensive and efficient computer program has been written to implement this procedure. The property estimating methods in the procedure are grouped into three categories, namely, the group contribution method for organic chemicals, the semi-empirical method for inorganic chemicals and that for structurally complicated materials. A unified set of 127 groups is used in the present group contribution method for estimating 25 properties and functions of gaseous, liquid and some solid organics, including the chemical enthalpy, chemical exergy, specific heat, heat of formation, Gibbs free energy change of formation, specific enthalpy, specific entropy, specific Gibbs free energy, critical properties and viscosity. The semi-empirical method is adopted to predict 28 physical properties and thermodynamic functions of inorganic chemicals. The values of certain properties for structurally complicated materials, such as coal, oil shale and biomass, are correlated semi-empirically as functions of the elementary composition, temperature and pressure. The procedure has been demonstrated satisfactorily. To facilitate its use, the procedure has been incorporated in the computer program PASS as part of its property estimation subprogram. Basically, PASS contains five subprograms and one comprehensive data bank. These five subprograms are the property estimation, process analysis, process synthesis, optimization and database. The comprehensive data bank currently contains approximately 7000 organic chemicals and 3000 inorganic chemicals frequently encountered in fuel and chemical industries.

4162 (DOE/METC—84-10, pp 229-237) **Analysis of coal liquids physical properties.** Khan, A.A.; Begovich, J.M.; Johnson, P.J. (Oak Ridge National Lab., TN). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—). Contract AC05-84OR21400.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Many coal conversion plant designs use physical property correlations that characterize a coal liquid by the cumulative weight boiling curve and specific gravities and molecular weights associated with that curve. Results of simulated material balances produced by using selected thermodynamic physical property correlations and the ASPEN simulator are compared to pilot plant data. To conduct this study, a preprocessing program, COALIQ, was developed which produces an ASPEN input file given the characterization data for the coal liquid and the selected correlations. Under moderate pressures and temperatures, reasonable K-values are obtained for systems containing only hydrogen, methane, and coal liquid; however, overall deviations are more pronounced near critical conditions. Because of the scatter of data for the cases examined, deviations caused by the use of different thermodynamic physical property correlations were not noticeable. Although the overall predicted mass balance for the P-99 pilot plant flash unit was close to the data, large deviations were noticed in individual component balances, particularly for water and the heavy coal liquid cuts. While the quality of pilot plant data may be questioned, equations of state that can accurately handle water-hydrocarbon mixtures and equations of state which behave robustly near the critical region should be included in ASPEN.

4163 (DOE/METC—84-10, pp 238-251) **Evaluation and enhancement of the ASPEN cost estimation system.** Carnegie, D.R.; Schwint, K.J.; Stern, S.S.; Millman, M.C.; Edelman, M.N.; Mendelson, M.A. (Scientific Design Co., New York, NY; Halcon Computer Tech., New York, NY; JSD Consultants Inc., Denver, CO). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Significant modifications were made to the basic cost algorithms contained within ASPEN in order to achieve better base cost estimates. This was done as part of a DOE contract to prepare a simulation model for the Great Plains plant. Additionally, a default set of parameters was developed to establish bulk material and construction labor (OE) cost factors as a function of equipment cost, based on in-house quotations and equipment purchased for petro-chemical plants, for a large number of equipment items. The current public version of the ASPEN CES has been enhanced by Halcon SD to correct many of the deficiencies. Existing cost models have been modified and new cost models have been developed utilizing HALCON SD's estimating techniques. A default method for obtaining OE costs based on ME costs has been incorporated into the ASPEN CES. These enhancements greatly improve the estimating accuracy of the ASPEN CES and permit its use for preparing study grade estimates of first-of-a-kind or pioneer process plants such as the Great Plains Gasification Plant.

4164 (DOE/METC—84-10, pp 262-278) **Thermodynamic and process constraints on coal gasification and their economic impact.** Shinnar, R. (City College of New York, NY). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The economics of coal gasification is strongly affected by the thermal efficiency of the gasifier. The cost of the gasifier itself is only a relatively small fraction (20 to 30%) of a total gasifier complex. A large part of the investment cost goes to the preparation of the steam and oxygen fed to the gasifier. Many gasifiers operate with large excess of steam. The energy invested to preparing this excess steam is hard to recover and the excess steam is expensive to condense and causes an increase in the cost of wastewater disposal. Oxygen is not only expensive, but excess oxygen strongly reduces the cold gas efficiency. Two simple parameters were developed that allow fast and efficient comparison of different gasifiers. The amount of oxygen and steam required is strongly constrained by the stoichiometry and by the thermodynamic equilibrium relations. However, only one gasifier, the British slagger, operates close to thermodynamic limitations. There is a distinct optimum operating region which is different for medium-Btu gas as compared to SNG. The effect of gasifier design, coal properties, and catalyst on the ability of a gasifier to operate close to the thermodynamic constraints are discussed.

4165 (DOE/METC—84-10, pp 279-290) **Computer-aided design and estimating of synfuels facilities.** Blecker, H.G. (ICARUS Corp., Rockville, MD). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The Office of Coal Research, US Department of Energy and the US Synthetic Fuels Corporation have been using the COST System developed by ICARUS Corporation to evaluate proposals and processes for synfuels facilities since 1971. The COST System uses minimal user input to develop preliminary equipment designs, simulate vendor costing procedures to derive a cost for equipment, generate a costed quantity takeoff for bulk materials, simulate detailed construction activities, and derive project-level and total costs. The System-generated designs and estimates make it possible to identify design deficiencies and cost discrepancies early in the life of a project. Application of the System to synfuels proposal and process evaluation has been successful. Experience with the use of the COST System in the evaluation of synfuels projects has demonstrated the System's high practical value. It can be used to screen proposals for feasibility, quality, and cost; and it can be used to optimize the design of plants and processes. Use of the System by the Federal Government has saved public time and money; and the comparison of actual costs, quantities, man-hours, and schedules with those developed by the COST System has justified the confidence of System users and validated its use.

4166 (DOE/METC—84-10, pp 291-301) **Market planning and pricing for new fuels and feedstocks.** Hagler, H.; Stafurik, J.W. (Hagler, Bailly and Co., Washington, DC). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

In recent years, a wide variety of new fuels and feedstocks has been developed in response to the large increases in the prices of conventional oil and natural gas. The new resources, based primarily on coal, face extremely complex problems in market planning and pricing, particularly in determining those early-entry market sectors, if any, that will allow the new gas, liquid or solid resource to command a premium price. To assist potential suppliers, users, and policy analysts in the examination of these complicated problems, Hagler, Bailly and Company has developed a set of computerized models and analytic techniques that allow a rapid and accurate evaluation of different product development strategies, negotiation strategies, energy policies, and R and D strategies. The general approach relies on three components: detailed market segmentation; economic and pricing analysis; and evaluation of market transition issues. In this paper, we discuss briefly the first and last components, while the bulk of the paper focuses on the second component, economic and pricing analysis. To illustrate the methodology, we use exhibits to summarize some results from recent studies.

4167 (DOE/METC—84-10, pp 302-311) **Use a process economics simulator for your pioneer studies.** Enyedy, G. (PDQ, Inc., Gates Mills, OH). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Process simulation, by definition, refers to the rigorous or empirical set of equations that describe mathematically some physical process. Chemical plants by nature are highly complex operations that require the power of computerized simulation techniques for meaningful studies. The incentive for simulation, however, is not the technical complexity of the plant, but to either establish the economics of the process or to improve them. Process analysis is not complete until the investment and operating costs have been determined. The key to process analysis is the plant investment estimate. The time stage of a process analysis study can offer us a choice as to what kind of simulator we use. When the flowsheet is sketchy or our study is exploratory, we can use a preliminary or, as this paper will refer to them, an economic evaluation simulator. If the process flowsheet is well defined and our objective is to optimize operating conditions or to look at different equipment arrangements, then we can use the more familiar engineering design simulator. The design of process simulators is examined in more detail to get a better understanding of how chemical engineering and cost engineering are coupled for a process study.

4168 (DOE/METC—84-10, pp 318-327) **Modeling of cyclic coal gasification.** Cleland, J.G. (Research Triangle Inst., Research Triangle Park, NC). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Production of medium-Btu gas from coal by cyclic gasification is an old process which involves alternating steam and air inputs to the reactor, thus separating combustion products from the nitrogen-free fuel gas. Competition from pure oxygen fired gas producers necessitates upgrading of the cyclic gasification process if it is to be considered as a future option. In a study at the Research Triangle Institute, cyclic gasification has been modeled both mathematically and experimentally to investigate basic phenomena influencing performance of such gasifiers, and to indicate improvements. Theoretical modeling solved the dynamic, one-dimensional, second-order expressions for mass and energy balances in the fuel bed, utilizing a Crank-Nicholson, predictor-corrector method. The model includes mass and heat diffusion and reaction kinetics. Results demonstrated: (1) improved performance with increased cycle frequencies (over that of commercial, cyclic water-gas sets); (2) single-direction steam flow without detrimental reaction zone migration, and with reduced ash slagging; (3) a rigorous approach to defining

reactor temperature limits; (4) minimal effects of mass diffusion; (5) influences of axial heat conduction on ignition rates and overall efficiency; (6) desirability of air preheat (but not steam superheat); (7) minimal advantages of high-pressure operation; (8) nonattainment of water-gas shift reaction equilibrium; and (9) sulfur evolution as H_2S or COS, with SO_2 negligible even during combustion (air-blow).

4169 (DOE/METC—84-10, pp 328-335) **Modeling and simulation of fixed-bed coal gasification reactors.** Joseph, B.; Bhattacharya, A.; Salam, L.; Dudukovic, M.P. (Washington Univ., St. Louis, MO). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

This paper presents a detailed mathematical model of fixed-bed coal gasification reactors. The model is developed based on differential mass and energy balances in the reactor and utilizes a shrinking core model for gas-solid reactions. Major accumulation terms are included to yield a dynamic model. Radial variations in temperature and conversion are also incorporated along with wall effects. The resulting system of partial differential equations are solved by a combination of orthogonal collocation and finite difference methods. The paper concludes with a comparison of the model predictions with experimental data from a laboratory fixed-bed gasifier. The results of this work would be useful in the design and operation of large-scale gasifiers. For example, the model can be used to find the optimum conditions for a given coal. The model will also be useful in transient simulation studies involving the gasifier and related process equipment.

4170 (DOE/METC—84-10, pp 336-343) **Transient simulation of coal gasification fuel plants.** Daniel, K.J.; Crapo, A.W.; Spradlin, L.W.; Dawes, M.H. (General Electric Co., Schenectady, NY). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—). Contract AC21-80ET14928.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Successful performance of control systems for future coal gasification fuel plants will be a key technical requirement. The objective of this study is to provide a transient simulation model of a coal gasification fuel plant, verified by experiments on the GE Process Evaluation Facility. This simulation will be a user-oriented engineering tool valuable for the evaluation of plant response to set point changes, identification of plant components that limit the plant response, and the evaluation of plant control strategies. The simulation was verified for a typical fixed-bed fuel plant system, and has been formulated in a modular structure so that alternative component models could be incorporated easily. The system simulation is highly user oriented as a result of the use of self-contained modular component models. The input and output of these component models appear as if they were the input and output of actual components. Consequently, an engineer using these models to develop a control system can quickly gain physical insight into the design problems. Component models have been developed for a general fixed bed gasifier, several types of direct and indirect heat exchangers, valves, pipes, PID controllers, and a combined-cycle power plant. All of the component models are based on first principles. This ensures that the component models are scalable to other configurations. Each component model is capable of functioning as a transient simulation independently. Each is self-contained and includes its own integration routine and initialization routine. The initialization routine contains initial values of the integrated variables as well as all the physical dimensions of the component. This allows easy scaling of the component model. The structure within each component model is user oriented and well documented so alterations can be performed quickly.

4171 (DOE/METC—84-10, pp 344-352) **Experimental verification of coal gasification models.** Daniel, K.J.; Dawes, M.H.; Smith, D.P. (General Electric Co., Schenectady, NY). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—). Contract AC21-80ET14928.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Analytic models of the steady state and transient behavior of the individual components and of the overall system of components that comprise a coal gasification plant are necessary to predict performance and evaluate control concepts. Experimental verification of these models by direct comparison of the predicted performance characteristics with measurements of actual pilot plant operation is required to give validity to the analytic models. Experimental verification is also necessary to demonstrate the applicability of the modeling technique to real world situations. The existence of a proven system model allows the development of a plant control system using the model to calculate desired stream set points for any given plant load point or ramp rate. Component and overall system models of an integrated coal gasification combined cycle power plant have been developed as described by Daniel et al. Steady state and transient operating regimes of the equipment, representative of the expected operating conditions which would be experienced in end-use applications, were imposed on the models, and the resulting responses were used to define experimental test requirements. The measured response of the experimental facility to the same variations as imposed on the model was used to determine any changes required in model assumption and to verify the experimental data. The overall system model was used to define required set points for the various input streams to achieve a given simulated plant output. Plant output demand was varied in transient operations designed to simulate expected utility use requirements, for example, frequency regulation and generator trip situations, and the model used to calculate stream set points. The model was also utilized to calculate simulated plant output based on the measured response of the Process Evaluation Facility.

4172 (DOE/METC/SP—212) **Advanced gasification projects.** (USDOE Morgantown Energy Technology Center, WV). Feb 1984. 59p. NTIS, PC A04/MF A01; GPO Dep. File Number DE84009286.

This report describes the results and accomplishments of the Morgantown Energy Technology Center's (METC) Advanced Gasification Program from 1 October 1982, to 30 September 1983. The primary goal of the program is to advance coal gasification technology through basic and applied research and development activities, at various research organizations in the private and public sectors. This goal is pursued through efforts to: (1) identify and demonstrate the feasibility of long-range, high-risk gasification concepts; (2) conduct research and development on gasification and its product/by-product treatment techniques; and (3) develop a comprehensive, fundamental knowledge base for industry to use in designing economically viable gasification systems. Program accomplishments are presented for the following tasks: (1) novel gasification concepts, chemistries, and processes; (2) gasification models; (3) fundamental coal structure and reaction mechanisms; and (4) gas stream processing and wastewater treatment. 168 references, 1 table.

4173 (DOE/OR/03054—109) **Existing technology transfer report. Liquefaction process and product studies.** Skinner, R.W. (International Coal Refining Co., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 184p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85001633.

Summaries of 4 internally funded research projects on coal liquefaction process studies performed at Air Products and Chemicals, Inc. between 1974 and 1980 are presented, and the production of carbon products from SRC are discussed. The effects of soluble and slurry catalysts on coal liquefaction yields and hydrogen consumption were examined. The coal process development unit was modified to permit coal slurries to be processed. A program was written to allow raw experimental data to be interactively entered into data files. The selectiveness and effectiveness of acid and caustic washing for removal of nitrogen compounds and phenols from SRC-I naphtha and middle distillates were determined quantitatively. Coal grinding methods were examined. Because of its condensed polyaromatic structure, coal has a much lower hydrogen-to-carbon (H/C) ratio than liquid petroleum-derived fuels. The economics of the SRC-I coal liquefaction process are improved by focusing on products having a low H/C ratio, so that the processing cost is minimized. Specialty carbon products are a very inviting market since they have very low H/C ratios, sell at premium prices, and are generally produced from petroleum. The products investigated included: anode coke and binder pitch for the aluminum industry; binder pitch for metallurgical coke; asphalt feedstock; carbon black;

and Bergbau SRC/polymer blend product. An extensive bibliography is included.

4174 **(DOE/PC/50046—15) Technical data analysis program. Final report.** (Pittsburg and Midway Coal Mining Co., Denver, CO (USA)). Nov 1984. Contract AC22-82PC50046. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003103.

Separate comprehensive final reports on the status of the SRC-II Demonstration Plant Design and on operating experiences at the Ft. Lewis and P-99 SRC pilot plants were prepared after the termination of those projects. However, time constraints made it impossible to consolidate all of the pilot plant data and operating experiences and relate these to the Demonstration Plant or future plant design. Most of the experimental programs during the later stages of pilot plant operation were in direct support of specific technical uncertainties identified in design work. The results of these programs would have been of substantial use in verifying or modifying design philosophy had the project proceeded. This technical data analysis project was undertaken to consolidate the pilot plant results presented in numerous reports under DOE Contract DE-AC01-79ET10104 for operation of the pilot plants, and to relate these results to specific Demonstration Plant uncertainties. The needs for and direction of future coal liquefaction research and development are also discussed. A list of all reports published under this SRC Technical Data Analysis Contract is provided as References 1 through 14 in this report. 16 references.

4175 **(DOE/PC/60798—4) Catalytic hydrotreatment studies with model compounds. Quarterly report, July 1-September 30, 1984.** Satterfield, C.N.; Smith, C.M. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemical Engineering). 1984. Contract FG22-83PC60798. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001847.

From studies at 375°C, and 6.9 MPa on a presulfided NiMo/Al_2O_3 catalyst it is shown that water vapor moderately increases the hydrodenitrogenation rate of quinoline, in either the presence or absence of H_2S. It does not significantly affect hydrogenation reactions in the reaction network but increases hydrogenolysis. Several changes in product distribution upon addition of water suggest that it increases the catalyst acidity. 11 references, 18 figures, 2 tables.

4176 (EUR—7633-DE-EN-FR-IT, pp 62-87) **Steam cracking of hydrogenated coal middle oils and model substances.** Hillebrand, W. 1982. (In German). Commission of the European Communities, Luxembourg. (CONF-8011177—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (24 Nov 1980).

The thermal cracking of coal middle oils, and tetralin and t-decalin as model substances was studied in a laboratory rig. Tetralin and t-decalin were cracked in the temperature range 700 to 890°C at retention times between 0.06 sec. and 0.4 sec. Tetralin was dehydrogenated mainly to 1,2 dihydronaphthalene and naphthalene whereas the crack products of t-decalin were mainly light olefins and BTX-aromatics. In both cases product yields are found to be a function of material conversion. Coal oil was initially hydrogenated in a two stage process and subsequently thermally cracked under the same conditions as for the model substances. Different hydrogenation conditions led to the formation of products of different aromatic content and these then yielded different amounts of ethylene at the thermal cracking stage. The maximum yields of major products from a coal middle oil comprising > 99% saturated compounds were: 25 wt% C_2H_4, 8 wt% propylene, 5 wt% C_4-olefins, 30 wt% BTX-aromatics. Compared to naphtha as starting material the ethylene yield in somewhat lower, propylene yield considerably lower, and BTX yields considerably higher. The characterisation indices (eg BMCI) developed for petroleum fractions are only suitable to a limited extent for the prediction of product distribution. High performance liquid chromatography was shown to be a good method for characterizing coal oils.

4177 (EUR—7633-DE-EN-FR-IT, pp 165-181) **Tar formation in the pyrolysis of hard coal at pressures up to 100 bar.** Arendt, P.; van Heek, K.H. 1982. (In German). Commission of the European Communities, Luxembourg. (CONF-8011177—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (24 Nov 1980).

Five different hard coal varieties were used to test the pyrolytic process under inert gas atmosphere and under hydrogen at pressures up to 100 bar in two apparatuses, which differ from each other essentially is their achievable heating rates. The gas components H_2, CH_4, C_2H_4, C_2H_6, CO, CO_2 and H_2O are determined quantitatively. Coke and tar are determined by weighing. The results clearly indicate that pressure, heating rate and gas atmosphere exert an influence on the quantity and composition of the tar. Low pressures and high heating rates under inert gas atmosphere lead to high tar yields. Increasing pressure and slower heating rates favor the break-down of tar through thermal cracking. Under hydrogen a distinct influence is seen at high pressure and slow heating rate. The tar yield is also increased by additional quantities of highly aromatic compounds which are liberated from the coals in the temperature range 500 to 770°C. High heating rates reduce this effect because the high concentration of break-down products present in the grain in this temperature range strongly inhibit the entry of hydrogen.

4178 **(NP—5770014) Reactivities of cokes from coal with different degrees of coalification during gasification with CO_2/CO mixtures.** Mueller, S. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 1 Dec 1982. 148p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770014.

The reaction kinetics of coal gasification was determined in the presence of CO and CO_2. The gas composition was determined by gas chromatography. Coals with different degrees of coalification were used for the coking experiments.

4179 **(PB—84-230036) Analysis of volatile products from the slow pyrolysis of coal. Final report November 1982-October 1983.** Felder, R.M.; Gilman, F.D. (North Carolina State Univ., Raleigh (USA). Dept. of Chemical Engineering). Aug 1984. 90p. NTIS, PC A05/MF A01.

The report gives results of a study of the evolution of volatile matter from coals of various rank during fixed-and fluid-bed pyrolysis. The pyrolyses were performed at temperatures ranging from 400 to 1000 C and with heating rates ranging from 1.5 to 6.0 C/s. Effects of equilibrium temperature, heating rate, coal rank, and reactor design on weight loss, elemental volatilization, gas species production and product composition, and tar/gas production ratios were examined. Lignite, sub-bituminous, and bituminous coals exhibited the same weight loss versus temperature profiles at slow pyrolysis rates. Toluene, xylene, ethane, and total sulfur yields versus temperature varied from fixed-to fluid-bed conditions. All other compounds measured showed no such dependence on reactor design. For all systems studied, tar-to-gas ratios were lower (although overall weight losses were greater) for slow pyrolysis than for rapid pyrolysis. Tar yields increased and carbon oxide yields decreased with increasing coal rank.

4180 **(PB—84-233238) Catalytic coal gasification.** Pullen, J.R. (International Energy Agency Coal Research, London (UK)). 1984. 60p. (ICTIS/TR—26). NTIS, PC $18.00.

Recent literature relating to the catalytic gasification of coal is reviewed. Inorganic species effective in promoting gasification in steam, carbon dioxide and hydrogen are salts of the alkali, alkaline earth and transition metals. Some studies undertaken to elucidate the mechanisms of catalysis have utilized simpler and purer carbon structures than coal in addition to coal chars. Several mechanisms have been proposed for the behaviour of catalysts in gasification but detailed mechanisms are still the subject of much speculation. However, in oxidative gasification, it is likely that an oxygen transfer mechanism is operative and a scheme is proposed which accommodates most of the theories put forward. In hydrogasification a 'spill-over' mechanism, whereby hydrogen is transferred to the

carbon structure, is feasible. The effects of coal properties on catalytic gasification and catalyst activity in terms of impregnation, dispersion and deactivation are discussed. (Copyright (c) IEA Coal Research 1984.)

4181 **(PB—84-237742) Laboratory investigation of the extrusion of North Dakota lignite fines for fixed-bed gasification. Report for September 1982-December 1983.** Furman, A.H.; Smith, D.P. (General Electric Co., Schenectady, NY (USA). Corporate Research and Development Dept.). Jan 1984. 49p. NTIS, PC A03/MF A01.

Sponsored in part by New York State Energy Research and Development Authority, Albany.

Lignite coal will be used as the gasifier feedstock in the first commercial substitute high-Btu fuels plant to be built in the U.S. The Great Plains plant, which is due to go on line in 1984, will use O2 blown, fixed-bed gasifiers to convert lignite coal into a medium Btu gas which is then upgraded to pipeline quality gas for final distribution. Since the fixed-bed gasifier requires a sized feedstock, up to 35% of the incoming run-of-mine lignite could be rejected as fines unless an alternative use can be found for the-1/4-inch fraction. Evaluation tests were run in the General Electric 6-inch single screw coal extruder to test the suitability of this process for utilization of lignite fines. Both organic and inorganic binders were evaluated. Tests were performed on the extrudate to evaluate their mechanical strength as well as their ability to withstand exposure to a high temperature gasification environment. Successful compacts were produced using bentonite clay, processed lignite coal tar, and a commercial coke oven pitch as the binding agent.

4182 **(PB—84-237759) Program to discover materials suitable for service under hostile conditions obtaining in equipment for the gasification of coal and other solid fuels. Phase 1. High Temperature Corrosion. Annual report January-December 1983.** Kim, K.Y.; Schaefer, A.O. (Metal Properties Council, Inc., New York (USA)). Apr 1984. 115p. NTIS, PC A06/MF A01.

See also PB83-210401. Prepared by IIT Research Inst., Chicago, IL.

This is a continuation during 1983 of a test program which began in 1975. Four test runs were conducted. One weldment test, Run 60 (1650 degree F - 0.5 vol. % H2S-500 psig), and three 'heat exchanger materials' tests, Runs 61 (1200 degree F - 1.0 vol. % H2-500 psig), 62 (900 degree F - 1.0 vol. % H2S-500 psig) and 63 (1500 degree F - 1.0 vol. % H2S-500 psig) were continued. Run 61 completed its scheduled 10,000 hr exposure test during the fourth quarter 1983. Corresponding gravimetric analyses and metallographic analyses were completed. Runs 60, 62 and 63 completed 9000 hr of exposure, and completion of their scheduled 10,000 hr exposure for all of them is expected during January 1984. Gravimetric analyses through 9000 hr and metallographic analyses on 1000 and 5000 hr specimens were completed for Runs 60, 62 and 63.

4183 **(PB—166081) Charring of western coals. Period of performance, July 1, 1962-December 31, 1963.** Berg, L.; Nickelson, R.L. (Montana State Univ., Bozeman (USA). Dept. of Chemical Engineering). 1963. 20p. NTIS, PC A02. File Number TI84901913.

Four coals were investigated for the production of char, creosote, and gas in a concentric vertical stainless steel tube carbonizer. Tested were 2-inch minus coal from O'Donnell No. 2 mine at Glenville, West Virginia; Brophy mine at Red Lodge, Montana; Kenilworth mine at Castle Gate, Utah; and the Elkol mine at Kemmerer, Wyoming. Yields of char, creosote, and gas were determined at 1000°F, 1250°F, 1500°F, and 1750°F. A thirty-day continuous run with the Utah coal was made at 1700°F to demonstrate the reliability of the equipment. An economic evaluation of the process as a substitute source for coke in the West is presented. Recommendations for future work include the suggestion that the char from these coals be converted into briquets suitable for the elemental phosphorus and non-ferrous metal smelting industries. 7 references, 1 figure, 11 tables.

4184 **(TNO-HMT—83-08424) Chemical crushing, part 2. Optimization of the crushing process.** Ansems, A.; Bloebaum, R.K. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Jul 1983. 117p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

Results are presented of research done to find the optimum conditions at which the physical chemical crushing of coal with ammonia takes place. Different process conditions and their influence on the crushing are investigated. Results on coals from different places in the world are presented. (In Dutch)

4185 **(TNO-KRI—278/83) Sulfur and ash reduction of pulverized coal by means of electrostatic separation (KRV-ESS: phase 1).** Bouwma, J. (Nijverheidsorganisatie TNO, Delft (Netherlands). Kunststoffen en Rubber Inst.). 1983. 61p. (In Dutch). Nijverheidsorganisatie TNO, Kunstoffen en Rubber Inst., Delft, Netherlands.

In the framework of the Dutch National Research Program for Coal several methods for reducing sulfur and ash content of coal are investigated and evaluated. TNO tested three electrostatic separation methods: (1) charging of particles by friction along the wall of a cyclone. Separation in a horizontal electric field; (2) charging of particles in a fluidized bed by multiple collisions. Separation in a vertical electric field, and (3) particles on a rotating roller are charged by corona. Separation by electrical, centrifugal and gravitational forces. A fourth method is examined by the Technical University at Delft: during free fall the particles are charged selectively and curved away. Decharging happens by corona. The cyclone separation gives the best results, with a separation of 70 to 80%, which can be improved to 90% when a two-step separation process is used. (In Dutch)

0105 By-products

REFER ALSO TO CITATION(S) 0105004148, 4149, 4173

0106 Properties

REFER ALSO TO CITATION(S) 0106004162, 4177, 4201, 4218, 4266

4186 **(BNL—35429) Pretreatment of coal by anodic electrolysis of acidified coal-water slurries. Final report.** Paul, D. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Chemical Engineering). Oct 1984. Contract AC02-76CH00016. 101p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85003518.

Preteatment of Pittsburg seam B coals to decrease its ash content and increase its solvent extractable material was investigated by anodically electrolysing acidified coal-water slurries at potentials around 1.0V SCE. The effects of the pretreatment were examined as functions of coal particle size, acid strength of the slurry, time of electrolysis and applied potential. The coal electrolysis was found to be most efficient at low acid strengths and short electrolysis times. The morphology of the coal surface changed with the conditions of the electrolysis and related to the percentage ash removal and the amount of solvent extractable material present in the coal. The anodic oxidation of the coal is suspected to occur via an electrocatalytic (EC) mechanism, whereby ferrous ions in the coal are first oxidized at the anode to the ferric state. The ferric ions migrate into the coal and accept electrons from accessible bonds in the coal micelle thereby reducing themselves back to ferrous ions and return to the anode for re-oxidation to the ferric state. The acceptance of electrons from certain bonds in the coal micelle results in the break-up of the micelle into simpler compounds. Accordingly, the solubility of the coal in an organic solvent should increase and this was found to be so when ferrous ions were externally added to the electrolyte. The electrolytic process was also found to transfer metallic ions present in the coal into solution in the electrolyte. 57 references, 26 figures, 1 table.

4187 **(CL—82/206) Characterization of two coal samples with the aid of electron microscopy in combination with X-ray microanalysis.** (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Jan 1983. 38p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, The Netherlands.

As part of a 'round robin' type of investigation commissioned by the Dutch Centre for Coal Specimens, two samples of coal, designated 16.001.000 (501 GB 28) and 16.002.000 (503 BE 33), were investigated by scanning electron microscopy combined with X-ray microanalysis. The results were set against data on a sample (V7DE) which had previously been investigated as part of a coal purification project, and which had shown promising purifiability. In the samples eight elements from the 'mineral' fraction and sulfur were determined quantitatively. The samples were then ashed in a current of singlet oxygen generated by a high-frequency discharge ('cold ashing'), and the ashes were analyzed likewise. The structural relation of minerals and macerals in the samples was estimated by morphological examination together with X-ray microanalysis of fractured as well as polished specimens. As regards the structural relation of minerals and macerals, samples 16.001.000 and 16.002.000 appeared to be very similar. The minerals were found to be present largely as granules intimately mixed with the macerals, not as layers between them. Sample 16.002.000 contained much less ferrous sulfide than sample 16.001.000, but in both samples the ferrous sulfide was present as inclusions in the macerals. In this respect they differed widely from sample V7DE, which has a markedly layered structure that allows macerals and minerals, including ferrous sulfide, to be more or less easily separated, and is therefore readily prepurifiable. (In Dutch)

4188 **(DOE/FE/60339—T5) Separation and fluorescence characterization of coal macerals. Final report, July 1, 1983-June 30, 1984.** Miller, D.M.; Crelling, J.C. (Southern Illinois Univ., Carbondale (USA)). 1984. Contract FC22-83FE60339. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001890.

One of the major problems in coal science is characterizing the individual maceral components of coal. While the most successful characterization has been done with petrographic methods, further characterization requires the availability of pure maceral concentrates. In the past, concentrates have usually been obtained by hand picking and have not been of the desired purity. The recent application of cell separation techniques of physiology to the problem of concentrating macerals shows great promise for obtaining exceptionally pure macerals. The overall objectives of this first-year proposal, which have been achieved, were to establish a facility for, and to begin to produce and characterize, maceral concentrates. A unique aspect of this work is that the two principal investigators have training and experience in the fields of coal petrology and physiology and, as was anticipated, this interdisciplinary effort has had synergistic effects. 5 references, 1 figure.

4189 **(DOE/FE/60339—T9) Microchemistry of Illinois coals - impact for sulfur removal. Final report, 1 July 1983-30 June 1984.** Hall, M. (Southern Illinois Univ., Carbondale (USA)). 1984. Contract FC22-83FE60339. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002890.

The distribution of elements (C, N, O, S, Na, Mg, Al, Si, Ca, and Fe) has been determined by point-to-point microanalysis of several maceral components of three samples of Illinois coal. The point-to-point variations for C, Si, Fe, and pyritic S were much greater in the exinites than in the vitrinites. The carbon content of exinites ranged from 40 to 70 weight percent and averaged 52 to 57%. The carbon content of vitrinites was higher, averaging 68 to 82%. The organic sulfur content of vitrinites was nearly the same as that of exinites, but the pyritic sulfur was much higher in the exinites. Both iron and silicon were higher in exinites than in vitrinites. In vitrinites, silicon ranged from 0.01 to 0.30% while iron was generally less than 0.1%. Nitrogen, sodium, and magnesium contents of these coals were near the limit of detectability, and no significant variations were noted. The organic sulfur content of the No. 5 coal and one of the No. 6 coals was in the range of 0.2 to 0.6%, while the other No. 6 coal had organic sulfur above 1% and total sulfur of 3.84%. The organic sulfur was easily distinguished from the pyritic or sulphatic sulfur forms by the local iron content and the variation in the sample current. The solvent-reacted samples showed only small changes in average composition. The differential thermal analysis curves for all three of the coals are remarkably alike, from room temperature to 850°C. The microanalyzed residues showed large reductions of organic sulfur content but only small changes in carbon content after heating. Coal samples heated in a microwave oven to 200°C for up to thirty minutes did not show significant changes in composition. 6 references, 4 figures, 5 tables.

4190 **(DOE/PC/40789—T11) Thermal and radiative properties of coal-ash deposits. Final technical report.** Anderson, D.W.; Vader, D.T.; Zumbrunnen, D.A.; Incropera, F.P.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 1984. Contract FG22-81PC40789. 117p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001084.

Experiments have been performed in two different facilities designed for steady-state heat transfer measurements in both coal ash deposits and surrogate porous materials. High temperatures in the samples were achieved by subjecting one surface to intense irradiation from an electric kiln. A water-cooled calorimeter and accompanying thermal guards located below a thin substrate plate supporting the samples served as a low temperature heat sink. The one-dimensional heat fluxes through the samples were measured calorimetrically. The test facilities, experimental methods, and experimental results are discussed. Effective thermal conductance measurements in coal ash samples were made for samples of flyash and crushed slag deposits, and also for a solid specimen of fouling superheater deposit. Hot surface temperatures ranged from 425°C to approximately 1420°C, with surface irradiation levels ranging from 25 to 500 $kW.m^{-2}$. Overall thermal conductances (including conduction and radiation transfer) were low, typically below 0.5 $W.m^{-1}K^{-1}$ for a 20 mm thick sample. Temperature profiles in the samples were determined using small diameter thermocouples located in the sample interior. Particle sintering and melting were observed to drastically affect temperature profiles and thermal conductances. Samples which underwent partial melting experienced irreversible changes in thermal conductance. Local thermal conductances within the samples showed this effect clearly, increasing as much as sixfold. 42 references, 29 figures, 5 tables.

4191 **(DOE/PC/70795—T1) Macromolecular chemistry of coalification. Quarterly report, August 1, 1984-October 31, 1984.** Larsen, J.W.; Kovac, J.; Shawver, S.E. (Lehigh Univ., Bethlehem, PA (USA). Dept. of Chemistry; Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 15 Nov 1984. Contract FG22-84PC70795. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002853.

The objective is to examine the changes in macromolecular structure which occur during coalification. Observance of these macromolecular changes will be used to provide insight into the complex coalification process. Scope of work includes the following: (1) extension of the well-established techniques for determination of the number average molecular weight between crosslinks, M/sub c/ of bituminous coals to low rank coals and lignites; (2) the number of hydrogen bond crosslinks and the number of ionic crosslinks will be calculated by comparing the M/sub c/ values of coals treated to remove hydrogen bond and ionic crosslinks with the M/sub c/ values of the native, untreated coals; (3) the molecular weight distribution of coal extracts will be measured; and (4) the statistical mechanics of coal polymerization and degradation will be investigated. Results to date show that low rank coals and lignites can be treated within the realm of regular solution theory to obtain anti M/sub c/ values. The presence of ionic crosslinks in the coals is established. 3 references, 4 tables.

4192 (EUR—7633-DE-EN-FR-IT, pp 236-262) **Relationships between petrographical and chemical properties of brown coals from the Rhein region.** Wolfrum, E.; Wawrzinek, J. 1982. (In German). Commission of the European Communities, Luxembourg. (CONF-8011177—).

From Round table meeting on chemical and physical valorization of coal; Brussels, Belgium (24 Nov 1980).

In the course of developing novel processing concepts for gasification, liquefaction and coking of brown coal it is necessary to improve the economics of the process by the use of optimal raw material. Detailed petrographical and chemical studies were carried out in order to describe more closely the behaviour of coal types characteristic of the Rheinland brown coal region during the valorization process. Relationships between petrographical and chemical characteristics were drawn up with the aid of correlation calculations and their connection described.

4193 **(NR—83/52) Characterizing coal samples with SEM/XRD. Progress report 1.** van der Burgh, N.; Timmer, J.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Apr 1983. 44p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

Seven coal samples were analyzed with the aid of scanning electron microscopy in combination with X-ray microanalysis to determine qualitatively the mineral elements. Also the coal samples were analyzed with regard to the kind and distribution of minerals, taking into account the manner, in which minerals and macerals were put together. (In Dutch)

4194 **(PB—84-237783) Synthesis and study of polymer models representative of coal structure. Phase 2. Annual report April 1983-April 1984.** Squire, K.R.; Solomon, P.R.; DiTaranto, M.B. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 2 May 1984. 163p. NTIS, PC A08/MF A01.

See also PB83-243980.

Seven new polymers were synthesized and an additional one was obtained from an outside source. There are now 10 ethylene bridged, 3 oxymethylene bridged, 1 ether linked, and 2 methylene bridged polymers available for study. A ring size series of benzene, naphthalene, and anthracene based polymers was completed. Polymers substituted with methyls, methoxyls, hydroxyls, and hydroaromatic rings were also made. The polymer characterization data were consistent with these functional groups and have provided insight into several pyrolysis mechanisms. Both oxymethylene and ethylene bridges seem to homolytically cleave during pyrolysis. Tar formation reactions in coals were coincident in temperature with ethylene bridge decompositions but were too high for oxymethylene bridges and too low for methylene bridges. Monomers with large aromatic rings and oxygenated ring substituents seem to destabilize ethylene bridges. This oxygen substituent effect may explain why low rank coals evolve tar at slightly lower temperatures than bituminous coals. Additional evidence has been obtained confirming that availability of donatable hydrogens plays a major role in controlling tar and char yields. Three distinct methane forming reactions were identified: homolytic decomposition of aromatic methoxyl groups, aromatic substitutions of methyl groups by tar molecules, and methane evolutions during char condensations. A Monte Carlo kinetic model was developed for the project's mechanistic studies. This model should greatly aid in efforts to relate the chemical structures of polymers and coals to their pyrolysis reactivities.

4195 **(SVF—150) Oil agglomeration of peat.** Forssberg, E.; Sundberg,S. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jan 1984. 25p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750210.

Studies and efforts so far have shown that it is difficult to achieve economy in using peat as a substitute for oil in heating plants. One reason is the high water content which has a negative influence on transportation cost and boiler efficiency. A second reason is the short season when peat can be harvested. Studies earlier made and reported in SVF-127 titled: Applicability of coal petrology methods of analyses in peat research, show that it is possible to use coal petrology techniques to make analysis on peat. Based on this knowledge it was thought that the technology used in dewatering of coal fines by oil agglomeration might also be applicable on pulverized peat. The results from the tests show - that peat does not agglomerate like coal - that the reduction of moisture obtained in the best test was from about 85 percent down to about 65 percent. This was reached by using an electrolyte $FeCl_3$ with or without oil additives - that the quantity of oil added after adding the electrolyte does not have any impact on the moisture content in the dewatered peat - that the quality of oil that has been added after adding the electrolyte does influence the moisture content in the dewatered peat - that when the electrolyte was substituted by tensides and/or flocculents worse dewatering results were obtained - that agglomeration of peat by pelletizing or briquetting under pressure, with or without previous adding of oil, did not result in lower moisture content.

4196 **(TNO-HMT—83-0317) Optimization of chemical analysis methods for coal and fly ash. 1. Sampling, sample preparation and proximate analysis.** Hissink, M. (Nijverheidsorganisatie TNO, Zeist (Netherlands). Hoofdgroep Maatschappelijke Technologie). Jan 1983. 29p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Zeist, Netherlands.

To support the experiments in the atmospheric fluid bed boiler (AFBB), many analyses of samples of fuel, additives and waste are needed. Therefore it was necessary to obtain experience with regard to sampling, sample preparation and analysis of these materials. For a correct interpretation of the experiments in the AFBB, a knowledge of accuracy of the results of these analyses is essential. This accuracy depends largely on the sampling method. As a guide for the methods to be used, the instructions in the relevant ISO Standards have been followed usually. A description is given of the procedures for sampling and analysis as well as of the equipment used. The accuracy that can be expected for the various results of analysis has been established experimentally. It was found in general that the requirements were met. (In Dutch)

4197 **(TNO-HMT—83-0454) Investigation of the feasibility of microelement analysis for the determination of the total sulfur content of coal products .** Rotscheid, G.J.; Staal, P.C.M.; Buis, W.J. (Nijverheidsorganisatie TNO, Zeist (Netherlands). Hoofdgroep Maatschappelijke Technologie). 1982. 14p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Zeist, Netherlands.

Aim of this investigation is to test a method for the determination of sulfur. In this method, used in the micro-element analysis of organic and organometallic compounds for the total sulfur determination in coal products, the tube-combustion method is applied. In a flow of oxygen a sample is heated to high temperature in a quartz tube. Sulfur compounds are quantitatively oxidized to sulfur dioxide and sulfur trioxide, which are converted into sulfuric acid by wet oxidation. Sulfate concentration is determined by titration with barium ions. The accuracy of this method appeared to be somewhat limited for sulfur contents of less than 0.2%, but can be improved significantly by using more sensitive titration indicator methods. (In Dutch)

0108 Waste Management

REFER ALSO TO CITATION(S) 0108004190, 5532

4198 **(CONF-841155—1) NOXSO process: a dry simultaneous SO_2/NO/sub x/ control technology.** Haslbeck, J.L.; Neal, L.G.; Wang, C.J. (NOXSO Corp., Paducah, KY (USA)). 1984. Contract FG22-84PC73225. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002521.

From 1. joint symposium on dry SO/sub 2/ and simultaneous SO/sub 2//NO/sub x/ control technologies; San Diego, CA, USA (13 Nov 1984).

The NOXSO process is an advanced flue gas treatment system which simultaneously removes 90% of both sulfur oxides and nitrogen oxides from flue gas. This is accomplished by chemisorption of the pollutants on a solid sorbent which is prepared by depositing Na_2CO_3 on the surface of gamma alumina substrate. The spent sorbent is subsequently regenerated to produce sulfur, nitrogen, and a reusable sorbent material. The process has a number of advantages over existing and proposed systems. The principal advantage is that the process removes 90% of all acid producing components in flue gas. The by-products of the process are marketable materials, as opposed to scrubber systems which create large quantities of solid or sludge wastes, and it is easily installed on either new power plants or as a retrofit to an existing plant. The process

is wholly owned by NOXSO Corporation. NOXSO is conducting an intensive research and development effort to develop the commercial potential of the process. The NOXSO test program has been underway for over two years. This paper presents a study of the process fundamentals to determine the process chemistry; chemical kinetics and the influence of various reaction parameters; studies of the sorbent behavior to determine sorbent properties that contribute to low attrition and efficient sorption; and studies of the process design to determine the physical size and costs of a commercial facility. 12 references, 8 figures, 1 table.

4199 **(DOE/FE/60181—84) Pilot-scale studies of in-furnace hydrated lime injection for flue gas SO_2 emission control.** Weber, G.F.; Bobman, M.H.; Schelkoph, G.L. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1984. Contract FC21-83FE60181. 21p. (CONF-841155—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002495.

From 1. joint symposium on dry SO/sub 2/ and simultaneous SO/sub 2//NO/sub x/ control technologies; San Diego, CA, USA (13 Nov 1984).

Simultaneous control of SO/sub x/NO/sub x/ emissions, derived from the combustion of low-rank coal, is under investigation at the University of North Dakota Energy Research Center (UNDERC). Process development work has been performed on both bench-scale and pilot-scale systems. Direct furnace injection of calcium-based SO_2 sorbent materials is the SO_2 control technique under evaluation. Furnace injection tests have focused on the direct injection of pressure-hydrated lime at flue gas temperatures ranging from 1500° to 3000°F (815° to 1650°C) followed by collection in a baghouse operated at temperatures up to 1000°F (540°C). Sorbent utilization values up to 55% at a Ca/S mole ratio of 1.0 have been observed. Eighty percent SO_2 reduction has been observed at Ca/S mole ratios of $\leq$ 2.0. Sorbent utilization in the baghouse has never exceeded 10% for baghouse temperatures ranging from 800° to 1000°F (425° to 540°C). Residence time and the temperature regime of the sorbent injection location appear to be the critical parameters controlling SO_2 reduction and sorbent utilization. 10 references, 16 figures, 2 tables.

4200 **(DOE/METC—85-1) Environment, safety, and health. Annual report, fiscal year 1983.** (USDOE Morgantown Energy Technology Center, WV). 1983. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE84011997.

METC's environmental management program covers the treatment and disposal of all wastewater generated at METC; the disposal of solid and hazardous waste generated by METC; and the monitoring of surface water, groundwater, and air quality in the surrounding area. In addition, technical assistance was provided in these areas to several offsite projects, which includes the Laramie Waste Management Project. Significant strides were made toward implementing the Wastewater Management Plan. Major accomplishments include completion of the interim upgrade of METC's existing wastewater treatment facilities, the preliminary design of a new wastewater pretreatment facility for METC, and the establishment of a groundwater monitoring program for the closing of METC's industrial waste pond. The safety program at METC has been expanded to meet the needs of a growing number of projects and personnel and to provide broad safety analysis as test equipment and controls become more complicated. The Process Safety and Environment Committee and the Site Safety Committee are also utilized to respond to onsite and offsite safety needs. In response to an increased emphasis on health hazards, the industrial hygiene program has expanded. The comprehensive program includes workplace health management, periodic inspections, exposure evaluations, chemical inventories, and respiratory protection. An effort was launched to consolidate information from work in the environment, safety, and occupational health and medical areas. A central filing system was developed for all ES and H documents. In addition, a project was initiated that would develop an ES and H Data Base for tracking and manipulating data and information.

4201 **(DOE/PC/40783—T16) Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1984.** Jordan, J.; Talbott, J. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). 1984. Contract FG22-81PC40783. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003230.

Task 1. Methods development for the speciation of the polysulfides. Work on this task has been completed in December 1983 and reported accordingly in DOE/PC/40783-T13. Task 2. Methods development for the speciation of dithionite and polythionates. Work on Task 2 has been completed in June 1984 and has been reported accordingly in DOE/PC/40783-T15. Task 3. Total accounting of the sulfur balance in representative samples of synfuel process streams. A systematic and critical comparison of results, obtained in the analysis of sulfur moieties in representative samples of coal conversion process streams, revealed the following general trends. (a) In specimens of high pH (9-10) and low redox potential (-0.3 to -0.4 volt versus NHE) sulfidic and polysulfidic sulfur moieties predominate. (b) In process streams of lower pH and more positive redox potential, higher oxidation states of sulfur (notably sulfate) account for most of the total sulfur present. (c) Oxidative wastewater treatment procedures by the PETC stripping process convert lower oxidation states of sulfur into thiosulfate and sulfate. In this context, remarkable similarities were observed between liquefaction and gasification process streams. However, the thiocyanate present in samples from the Grand Forks gasifier were impervious to the PETC stripping process. (d) Total sulfur contaminant levels in coal conversion process stream wastewater samples are primarily determined by the abundance of sulfur in the coal used as starting material than by the nature of the conversion process (liquefaction or gasification). 13 references.

4202 **(ECN—83-085) Leaching of trace elements from coal ash and coal ash products.** van der Sloot, H.A.; Wijkstra, J.; van Stigt, C.A.; Hoede, D. (Netherlands Energy Research Foundation, Petten). May 1983. 64p. (In Dutch). (CONF-830424—). Netherlands Energy Research Foundation, Petten.

From 4. international ocean disposal symposium; Devon, UK (11 Apr 1983).

Laboratory leaching studies with coal ash and coal products were performed in fresh water and seawater to study the differences in leaching behavior of trace elements. The classification of coal ashes in acidic, neutral and alkaline ashes proved to be useful in assessing the leachability of trace elements both in fresh water and in seawater. Experiments with pulverized ash products resulted in a measure for the maximal leachable fraction. Diffusivity measurements in coal waste blocks were carried out on an unexposed and exposed block (1.5 years submerged). The calculated effective distance of diffusion was compared to the measured distance of diffusion obtained by analyzing a depth profile of the recovered coal waste block. In the calculation of the diffusivity of various elements in coal ash products the availability for leaching has to be accounted for to match the observed distance with the experimental data. (In Dutch)

4203 **(INTRON—82272) Bottom ashes: a literature study.** van der Wegen, G. (INTRON B.V., Maastricht (Netherlands)). Jun 1983. 42p. (In Dutch). INTRON B.V., Maastricht, Netherlands.

A survey of knowledge relating to bottom ashes from powdered coal fueled utilities is presented. A literature study supplemented with personal communications from users and producers of bottom ashes in the Netherlands is presented. Presently bottom ashes might be used in the Netherlands for road building, lightweight bricks and drain or filter bed material. (In Dutch)

4204 **(INTRON—83006) Fly ash aggregates.** (INTRON B.V., Maastricht (Netherlands)). Mar 1983. 201p. (In Dutch). INTRON B.V., Maastricht, Netherlands.

A study has been carried out into artificial aggregates made from fly ash, 'fly ash aggregates'. Attention has been drawn to the production of fly ash aggregates in the Netherlands as a way to obviate the need of disposal of fly ash. Typical process steps for the

manufacturing of fly ash aggregates are the agglomeration and the bonding of fly ash particles. Agglomeration techniques are subdivided into agitation and compaction, bonding methods into sintering, hydrothermal and 'cold' bonding. In sintering no bonding agent is used. The fly ash particles are more or less welded together. Sintering in general is performed at a temperature higher than 900 deg C. In hydrothermal processes lime reacts with fly ash to a crystalline hydrate at temperatures between 100 and 250 deg C at saturated steam pressure. As a lime source not only lime as such, but also portland cement can be used. Cold bonding processes rely on reaction of fly ash with lime or cement at temperatures between 0 and 100 deg C. The pozzolanic properties of fly ash are used. Where cement is applied, this bonding agent itself contributes also to the strength development of the artificial aggregate. Besides the use of lime and cement, several processes are known which make use of lime containing wastes such as spray dry absorption desulfurization residues or fluid bed coal combustion residues. (In Dutch)

4205 **(KHM-TR—68) Disposal of coal burning wastes.** Meijer, J.E. (Statens Vattenfallsverk, Vaellingby (Sweden). Projekt KOL-HAELSA-MILJOE). Dec 1983. 125p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750213.

This report is a second literature synopsis concerning disposal of coal burning waste within the KHM-project. A large amount of ash and FGD-wastes in the US are disposed either wet or dry. Approximately 5 - 10 percent of the ash is utilized in one way or another, for example in the cement industry. Most of the utilies pump ash in an ash-water mixture (slurry) to ash ponds. Of utilities with FGD-equipment, 28 as of today, 60 percent use wet disposal of the resultary sludge. The rest of the utilities dewater the sludge and use dry disposal techniques, so far always together with ash. Of utilities that employ wet disposal, 67 percent use unpacked dams. The most serious environmental hazard concerning disposal of ash and FGD-products is the danger of contamination of runoff and groundwater through leaching. A large number of experiments, measuring the quality of runoff and groundwater at disposal sites, have been made. These experiments do not give a complete answer to problems concerning the magnitude of contamination. Contamination of runoff at dry disposal sites has not been examined. Methods for localization of disposal sites for coal burning waste are well described in available literature. The technical design of both wet and dry disposal sites is very well covered in the literature. Details concerning the technical design of a disposal site depends on the natural condition of the chosen site. In referred literature, examples are given of design in different types of terrain. These examples are often described in detail. The cost of disposal has been evaluated in several investigations. This report contains a comparison between wet and dry disposal for a utility of about 500 MW. Evaluated yearly costs show that wet disposal (closed loop) is approximately 2.5 times more expensive than dry disposal.

4206 **(PB—84-223460) Use of coal wastes for the production of alumina. Report for September 1979-December 1983.** Sohn, H.Y. (Utah Univ., Salt Lake City (USA). Dept. of Metallurgy and Metallurgical Engineering). 29 Dec 1983. 71p. NTIS, PC A04/MF A01.

Sponsored in part by Grant G1195049.

The primary resource for aluminum at the present time is bauxite. The United States has become more and more dependent on foreign sources for its supply of this strategic material because of its small bauxite resources, which are considered inadequate as a long-range supply. However, domestic low-grade aluminum resources, including coal waste, are considered unlimited. The development of a suitable method for using coal wastes will also alleviate their disposal problems. This report describes three methods of extracting alumina from domestic coal wastes using their carbon contents as a fuel and a reductant of silicates contained therein.

4207 **(TNO-HMT—83-01613) Potential applications of the residual materials resulting from the cleaning of coal prior to combustion.** Walpot, J.I. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Mar 1983. 52p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

In the framework of an investigation into the cleaning of coal prior to combustion by using physical and biological processes, a review has been made of potential applications for the residual materials resulting from these cleaning processes. Among other things literature on coal flotation wastes is used for this review. Applications offering the best prospects in this respect are: addition in pulverized coal combustion; fuels/raw materials in cement production; fuels/raw materials in brick manufacture; fuels in fluid-bed combustion. Particularly with regard to the last quoted method of processing some research work has still to be carried out to find out whether it will actually be possible to use the residual materials resulting from coal cleaning for this application. (In Dutch)

4208 **(TNO-HMT—83-01620) Literature survey concerning measuring methods of the oxidation of nitric oxide in stack plumes.** Vermeulen, P.E.J. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Apr 1983. 69p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

A literature survey of measuring methods used for measuring oxidation of nitric oxide in stack plumes of fossil-fueled power plants is presented. (In Dutch)

4209 **(TNO-KRI—145/83) Capture of fly ash from an AFBC boiler with the aid of electric filters.** de Haan, P.H.; de Groot, J.L.B. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). May 1983. 43p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

The inhalable fraction of fly ash (particle size 0.2 to 2 micron) is captured by newly developed filters using electrostatics. Experiments performed using sand are described, and tests performed using flue gas from an atmospheric fluidized bed boiler are also described. (In Dutch)

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 0109004202, 4205, 4268, 4272, 5331, 5335, 5344, 5534, 5535, 5536

4210 **(BNL—51542, pp 4-10) Coal stoves.** Fischer, H.E. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The environmental impact of the residential use of coal stoves and furnaces is discussed. Fixed-bed residential coal furnaces can have high emission rates for particulates and polycyclic organic matter (POM). It has been estimated that POM emissions from residential stoker-fed bituminous coal units are 1900 times that of gas and about 450 times that of oil, for equivalent heating content. Estimates of the contribution from residential coal combustion to total US POM emissions have ranged from 3.4% to 85%. POM emissions depend on several variables, such as the type and composition of coal and the furnace design. The health hazards associated with POM are presented.

4211 **(EPRI-CS—3723) Continuous emission monitoring guidelines.** Eggleston, T.E.; Roberson, R.L. (Kilkelly Environmental Associates, Inc., Raleigh, NC (USA)). Nov 1984. 446p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $35.50. File Number TI85920134.

Various federal and state regulations establish continuous emission monitoring (CEM) requirements that affect the electric utility industry. These regulations continue to expand in scope and applicability, requiring more and more utility companies to operate and maintain complex and maintenance-intensive CEM systems. The complexity and diversity of the various CEM systems that are available, along with general unfamiliarity with the systems, have historically created problems for many utility users. This guideline manual was developed to assist current and future utility users in the selection, installation, operation, and maintenance of CEM sys-

tems. In addition, a regulatory decision path is provided to assist in determining which, and to what extent, monitoring regulations apply to a specific steam generating unit. This manual is designed to be flexible and to serve both as a comprehensive primer and as a reference manual for CEM systems. To assist in the procurement of CEM systems, a Request for Proposal preparation package is included. This package includes both suggested Terms and Conditions and recommended Technical Specifications, along with instructions for site-specific completion of the package. 4 references, 11 figures.

4212 **(PB—84-220318) Effect of underground coal gasification on groundwater. Summary report.** Walters, E.A.; Niemczyk, T.M. (New Mexico Univ., Albuquerque (USA). Dept. of Chemistry). Jul 1984. 118p. NTIS, PC A06/MF A01.

The potential effect of underground coal gasification on groundwater has been examined in a laboratory study. The study was directed at Fruitland Formation subbituminous coal of the San Juan Basin and at the groundwater found in this coal seam. Two wells were drilled into the coal seam at a potential UCG test site. Groundwater samples and core samples of overburden, underburden and coal were analyzed to establish baseline characteristics. A number of static leaching and sorption studies were performed on the overburden, underburden, and coal. Ash was prepared at several different temperatures and leaching characteristics were examined. Cations of the trace elements Be, Al, Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Hg and Pb and the anions F(-1), AsO4(-3), SeO3(-2), and MoO4(-2) were selected for coal sorption studies. Distribution coefficients for sorption on coal were determined for the cations and anions under conditions reasonably similar to those in the groundwater of the San Juan Basin. The effect of humic acid on the sorptive characteristics of coal was studied.

4213 **(PB—84-236710) Effects of longwall mine subsidence on overlying aquifers in western Pennsylvania. Open file report 26 September 1979-25 January 1984.** Pennington, D.; Hill, J.G.; Burgdorf, G.J.; Price, D.R. (SMC Martin, Inc., Valley Forge, PA (USA)). May 1984. 130p. NTIS, PC A07/MF A01.

Ground Water levels and subsidence were monitored over a longwall panel of a deep coal mining operation located in western Pennsylvania. The monitoring network includes 11 ground water monitoring wells completed to measure water level changes in separate shallow and deep aquifer zones and 50-ft surveyed subsidence stations parallel and perpendicular to the panel centerline. Monthly monitoring data were collected during the premining, mining, and postmining time periods. Aquifer testing and borehole geophysical logging were conducted during premining and postmining conditions to document any changes in aquifer properties and ground water flow patterns. Results indicate ground water declines were located with respect to the mining face and mined longwall panel. Dewatering of the deep aquifer zone caused a significant water level decline in deep wells; however, the shallow aquifer zone was isolated from major impacts by an aquitardal layer during the 1-yr period. Transmissivity data were greatly impacted by fracturing in the highly anisotropic aquifer system. Borehole geophysical logging indicated changes in ground water flow patterns and zones of increased fracturing from subsidence.

4214 **(TVA/PUB—84/81) Cumulative hydrologic impact assessment of coal surface mining in north Georgia - surface water.** Poe, M.L.; Betson, R.P. (Tennessee Valley Authority, Norris (USA)). Oct 1983. 83p. NTIS, PC A05/MF A01. File Number DE85900241.

Flow and water-quality data for surface water in the north Georgia coal region is presented in this report. The data were collected by TVA and the USGS; the TVA data were collected in July 1981 and the USGS data were collected primarily from 1979 through 1981, with some dating back to 1976. An analysis of the potential for surface-water quantity and quality problems due to future surface mining of coal is also presented. Several areas exhibiting this potential are listed, with the potential for erosion being the most widespread and the potential for acid drainage being localized but more difficult to prevent. 43 references, 6 figures, 14 tables.

0120 Mining

REFER ALSO TO CITATION(S) 0120004213, 4269, 4272

4215 **(ACIRL-PR—84-6) Mining under claystone roof in the Munmorah - Vales Point area. Progress report on field trials at Newvale no. 2 colliery.** Olsen, P. (Australian Coal Industry Research Labs. Ltd., North Ryde). Mar 1984. 157p. Australian Coal Industry Research Labs. Ltd., North Ryde.

Mining of the Great Northern seam in the Munmorah Vales Point area has been severely restricted by the presence of overlying claystone of varying thickness. A mathematical model study was undertaken which showed that, with an opening 4.8 m wide by 1.8 m in height and radius corners at the roof and leaving 1 m of coal as roof, a stable roadway was feasible. Field trials using this plan were conducted. These have proved successful.

4216 **(BM-IC—8973) Mine ground control.** (Bureau of Mines, Washington, DC (USA)). 1983. 161p. (CONF-831298—; CONF-831299—). Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281.

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

These proceedings consist of papers presented at Bureau of Mines Technology Transfer Seminars in December 1983 for the purpose of disseminating recent advances in mining technology in the area of mine ground control. The Bureau of Mines conducts several of these seminars each year in order to bring the latest results of Bureau research to the attention of the mining industry as quickly as possible. All sixteen papers have been entered individually into EDB and ERA. (LTN)

4217 (BM-IC—8973, pp 4-14) **Geologic studies in ground control.** Moebs, N.N. (Bureau of Mines, Pittsburgh, PA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Several geologic techniques are reviewed that are useful in planning mines and in solving ground control problems. A summary is presented of a study of coal mine roof structures and the use of this information in improving supplementary support and anticipating support problems. 20 references, 6 figures.

4218 (BM-IC—8973, pp 15-35) **Coal and rock properties for premine planning and mine design.** Thill, R.E. (Bureau of Mines, Minneapolis, MN). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Nearly all phases of the mining operation require input on the engineering properties of rock. Engineering properties are particulary useful in the premine investigation and mine design phases of the mining operation. Because of the general scarcity of engineering property data for coal measure strata in major US coal districts and the lack of organized data bases to house and disseminate such information, the Bureau of Mines undertook a wide-ranging testing program to determine engineering properties of coal measure rocks in several US coal basins. The Bureau also initiated the development of a data base for the housing, sorting, manipulation, and retrieval of property data by computer. Typical results are given for both field and laboratory determinations of geotechnical, mechanical, and geophysical properties. 6 references, 22 figures and 4 tables.

4219 (BM-IC—8973, pp 36-48) **Pillar design equations for coal extraction.** Babcock, C.O. (Bureau of Mines, Denver, CO). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Coal mine pillar design equations developed during the period 1833 to 1980 are reviewed. These equations suggest that mine pillars of different sizes are required for safety. Two widely used design equations, those of Wilson and Wardell, give pillar areas that vary by an average factor of 2.08. The pillar width and height alone are not the primary parameters in the design problem. The Mohr-Coulomb stress-failure criteria can be used to explain the difference in the estimated pillar sizes. 27 references, 11 figures, 6 tables.

4220 (BM-IC—8973, pp 49-63) **Underhand cut-and-fill stoping for rock burst control.** Jenkins, F.M.; Dorman, K.R. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The occurrence of rock bursts in deep metal and nonmetal mines presents a major hazard to their safe and economical operation. As part of a Bureau of Mines program to reduce rock bursts in deep vein mining, a project was conducted in the Coeur d'Alene mining district of Idaho to evaluate and demonstrate the mining of a destressed sill pillar using underhand cut-and-fill methods. A 50-ft still pillar in a burst-prone area was preconditioned by drilling and blasting vertical holes in the ore. After raises were driven through the destressed pillar to the level above, it was mined by the underhand cut-and-fill method. The conclusion from this demonstration is that the combination of ore preconditioning and underhand mining resulted in greatly improved rock burst and ground control, allowing safe and efficient mining of a potentially hazardous, burst-prone pillar. 11 figures, 1 table.

4221 (BM-IC—8973, pp 64-74) **Acoustic cross-borehole system for hazard detection.** Radcliffe, K.S.; Thill, R.E. (Bureau of Mines, Minneapolis, MN). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

A high-frequency (20 kHz) acoustic cross-borehole system has been devised and field tested to remotely investigate the structural conditions of a rock mass in advance of mining. Elastic properties of the rock can be determined by monitoring acoustic waves generated between boreholes, and the structural integrity of the rock mass can be interpreted by evaluation of the acoustic signal characteristics. Identification of hazardous ground conditions prior to mining can help reduce, and ultimately prevent, injuries and fatalities to miners as well as interruptions in the mining operation due to encounters with unstable ground and geologic hazards. 6 references, 7 figures, 1 table.

4222 (BM-IC—8973, pp 75-88) **In-seam geophysical techniques for coal mine hazard detection.** Leckenby, R.J.; Snodgrass, J.J. 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Four geophysical methods - synthetic pulse radar, high-frequency seismic, guided waves, and borehole velocity logging - were investigated by the Bureau to devise better in-seam hazard detection techniques. It is anticipated that these techniques will complement each other and will provide a valuable tool to the mining industry. The synthetic pulse radar provides high-resolution reflection capabilities in the range between 10 ft and 200 ft. The high frequency seismic method, when fully developed, should provide near-range, up to 30 ft, high-resolution reflection detection capabilities, and the lower resolution, long-range guided-wave method using the control sources will provide detection in the hundreds of feet. The borehole sonic probe will be useful for determining the seismic velocities needed for both the high frequency seismic and guided-wave methods. Research is continuing on all four methods. This paper demonstrates the potential of the methods. Further research, development, testing, and actual use are required to reach the expectation that is expected for each method. 2 references, 19 figures.

4223 (BM-IC—8973, pp 89-95) **Satellite imagery as an aid to mine hazard detection.** Speirer, R.A.; Moll, S.H. (Bureau of Mines, Denver, CO). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The Bureau of Mines is involved in ongoing research to develop potential hazard evaluation maps for mine areas. These maps will be generated using computer-aided methods to analyze Landsat imagery and multivariate data sets. A means of image processing whereby lineament information is enhanced and extraneous information suppressed has been deivsed. Digital processing is particularly appropriate for picking lineaments from Landsat data because it is faster, less biased, more repeatable and, ultimately, less costly than manual interpretation. Since much of the current work in providing linament information to mine planners is done by MSHA, the Bureau intends to work closely with MSHA in developing the methodology. It is hoped that eventually MSHA will have image processing systems in their field offices where a semi-automatic analysis can be generated locally for mine operators. 5 references, 3 figures.

4224 (BM-IC—8973, pp 96-107) **Microseismic techniques applied to failure warning in mines.** Leighton, F.W. (Bureau of Mines, Denver, CO). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The microseismic technique has developed into a potential tool that can provide for vastly increased safety to mine personnel and can be used as an aid in production planning and problems. To demonstrate this, clear-cut and highly successful applications have been shown; however, problems and deficiencies of the present technique do exist. Reliability is the foremost of the problems with microseismic techniques at their present level of development. Reliability does not mean equipment reliability, although microseismic systems do require constant maintenance and attention, but rather the fact than not all failures are predicted as easily or clearly as those presented, and sometimes indicated failures may not occur. This presents the user with the problem of determining how many times he is willing to be wrong. Experience has shown that the technique has undeniable potential and is beneficial in its present form when properly used. That same experience, however, shows that at times, false alarms will be sounded, and even worse, sometimes no alarm will be sounded when one was necessary. The reliability problem cannot be attributed solely to improper use of microseismic systems or inadequate analysis of their data. The solution to the problem lies in further research to develop better and more accurate methods of data analysis, and possibly the incorporation of supplemental methods to be used in conjunction with the application of microseismic techniques. While not perfect, the positive aspects of the method generally outweigh the potential problems to the user. Current Bureau research, in both hard rock and coal mine environments, is aimed at establishing better utilization of the microseismic technique.

4225 (BM-IC—8973, pp 108-116) **Mechanical and ultrasonic closure rate measurements.** McVey, R. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The Bureau of Mines has constructed two intrinsically safe closure rate instruments that provide the mine operator a means for predicting an imminent roof fall during pillar robbing. This improves operator and machine safety and prevents delays in digging out equipment. One instrument system consists of two rugged retrievable extensometers connected by long electrical cables to a digital readout unit for reading closure and closure rate. Once a predesignated closure rate is reached, the extensometer is retrieved by pulling it from the imminent roof fall area by its electrical cable. The equipment and mine personnel are also pulled back to await the fall, which usually occurs within minutes after the designated

rate is reached. Although the unit is primarily designed for retreat mining operations, it can be used for any activity requiring measurement of displacement or rate of displacement. Measurement range is 0 to 6 in with 0.1% accuracy for openings of 4 1/2 to 12 ft. The Bureau is also evaluating a small ultrasonic unit to make these measurements. The new instrument provides unobstructing measurements up to 35 ft. The ultrasonic transducer can be attached to a roof bolt, tossed into an unsupported area, or handheld. Total distance and rate of change are displayed digitally to 0.001 ft. 9 figures.

4226 (BM-IC—8973, pp 117-121) **Remote manual roof bolters.** Bevan, J.E. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Coal mine accident statistics show that 18% of all roof-fall fatalities involve roof bolting. This is 30% higher than for any other occupation category. Industry analyses show that roof bolters were involved in 15% of lost-time accidents. Rapid placement of permanent roof support appears essential to safety as well as long-term roof stability. The Bureau of Mines has addressed these problems through two areas of research: (1) by removing the bolter operator from the immediate dangers of bolt installation; and (2) by providing means for a safer and more timely bolting system. 2 figures.

4227 (BM-IC—8973, pp 122-125) **Field test of an automated temporary roof support (ATRS) used on a low-coal, single, fixed-head roof bolting machine (squirmer).** Chislaghi, C.T.; Marshall, T.E. (Bureau of mines, Pittsburgh, PA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

An economical, remotely operated (automated), temporary roof support (ATRS) has been developed by the Bureau of Mines for use on a single, fixed-head roof bolting machine (squirmer) that operates in low-coal seams (< 42 in thick). This ATRS eliminates the need for workers to go under unsupported roof to set or remove temporary support prior to or during the roof bolting cycle - a task that annually accounts for approximately 20% of all roof fall fatalities. It can be adapted on any squirmer used in the US low-coal fields. A prototype ATRS, designed and built at the Bureau's Pittsburgh Research Center, was field-tested at Imperial Colliery Co.'s Mine No. 20 in Eskdale, WV. The Mine No. 20 amended roof conrol plan, which requires the use of the Bureau's ATRS as temporary support during face bolting, has been approved by the Mine Safety and Health Administration (MSHA). 1 figure.

4228 (BM-IC—8973, pp 126-128) **Development of epoxy grouts and pumpable bolts.** Thompson, R.R. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Good roof control is critical to the coal mining industry. The Bureau of Mines recognized the need for a remotely placed roof bolt of noncorrosive materials, which could be remotely installed in longer-than-seam-height lengths. The system developed has a fiberglass core. The core is made up of four 1/4-round sections, which can be coiled on the machine for storage and then formed into a hollow core during insertion into the drilled hole. The adhesive used is a fast-setting epoxy resin. The resin was tested underground in cartridge form. The test results showed bonding strengths greater than those available with the polyester resin now being used. Core handling and pumping equipment was designed, built, and placed on an existing roof bolter. The equipment is now being laboratory-tested and will be tested underground in a coal mine using a standard MSHA-defined, two-intersection test.

4229 (BM-IC—8973, pp 129-132) **Development of lightweight hydraulic supports.** Dunford, J.P. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The installing of temporary roof support is an integral part of underground coal mining. The most common forms of temporary supports are wooden posts and metal jacks. Both wooden posts and nonyielding steel jacks are heavy and cumbersome to install. Yielding hydraulic jacks, while easier to install and more functional, are extremely heavy. With this in mind, the Bureau of Mines studied ways to reduce the weight of contemporary hydraulic supports without sacrificing performance. In 1979 a contract was awarded to design and test a lightweight hydraulic mine support. Laboratory testing indicated some changes were needed in the basic design selected. After these modifications were made, 33 units were sent to the field at three different locations. These units were designed for use in a 6- to 8-ft seam, have a 22-ton capacity, are fully self-contained, provide a 5- to 7-ton roof preload, and yield to overload. The total weight of each unit is 55 lb, compared with 110 lb for a commerical steel unit. All three of the Western coal mines were extremely pleased with the units and requested to keep using them for as long as possible. During the field testing some problems did occur, such as corrosion on the piston surfaces, weak pump handles, and short life span of some internal seals. All of these problems were corrected. During the field tests, the need became apparent for units that would function in seam heights other than 6 to 8 ft. Units of the same configuration and capacity were built and tested for seam heights in the 4.5- to 6-ft, 8- to 10-ft, and 10- to 12-ft ranges. After the testing proved successful, arrangements were made to install 10 of the 10- to 12-ft units in a mine for field testing.

4230 (BM-IC—8973, pp 133-137) **Mobile roof support and applications in retreat mining.** Thompson, R.R. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

Retreat pillar mining is highly productive, but dangerous. The primary danger during pillar removal is premature caving of the roof. The Bureau of Mines has developed a remotely operated machine that will place and retrieve temporary roof support. The prototype machine worked well but had several problems, the primary one being tramming. Two second-generation machines were built under a cost-sharing program with a Utah coal mine and a mining equipment company. The machine carries four 50-ton jacks and is remotely controlled by radio. The machines are presently being tested underground in a Utah coal mine.

4231 (BM-IC—8973, pp 138-145) **Inorganic grouts for roof bolting.** Fraley, J.E. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

The Bureau of Mines investigated rapid-hardening material substitutes for the resin used in mine roof bolts. Gypsum plasters ($CaSO_4 \cdot 1/2H_2O$) were selected because they have high early strength while being readily available and inexpensive. Gypsum plaster-water capsule cartridges provide a substitue for resin cartridges. Gypsum plaster holds promise for injection in roof bolt holes as a premixed slurrry because of improved operator safety and greater economy. 8 figures.

4232 (BM-IC—8973, pp 146-155) **Research, development, and use of steel-fiber-reinforced concrete cribbing for mine roof support.** Smelser, T.W.; Didcoct, D.A. (Bureau of Mines, Spokane, WA). 1983. Bureau of Mines, 2401 E. Street N.W., Washington, DC 20241. File Number TI85900281. (CONF-831298—; CONF-831299—).

From Bureau of Mines technology transfer seminar on mine ground control; Pittsburgh, PA, USA (6 Dec 1983).

There is no question of the strength and longevity of the steel-fiber-reinforced concrete cribbing and its success in present installations. Although wood has been the traditional material in use for roof support in the mining industry, the problems of supply and cost are increasing rapidly to the point where a viable alternative must be found. Concrete products are readily available in all parts of the country, and, indeed, the world. The steel-fiber-reinforced concrete cribs are proving to be the answer to many roof control problems experienced in the past and are the most economical alternative to wood. One industry source in the field of mine safety asserted: the new cribs are much safer due to the inherent characteristics of steel reinforced concrete. We have had no failures, and we have long-term installations in which we have confidence that these cribs are a reliable source of roof support. Some mines have already decided that, in their operations, wood cribbing is a thing of the past. 11 figures.

4233 **(DOE/MC/19334—1692) Development potential of coalbed methane in the Warrior Coal Basin of Alabama. Chapters 1, 2, and 3.** (Alabama Univ., University (USA). School of Mines and Energy Development). May 1984. Contract AC21-82MC19334. 190p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85003301.

From its modest beginnings as a mine degasification R and D effort in 1971, the coalbed methane industry in Alabama is now poised for major development. As of July 1984, 135 wells were producing gas and an additional 52 were in various stages of development. A characteristic of most development thus far has been its association with underground coal mining. Mine degasification wells now comprise over 85% of the total of producing wells. Commercialization is underway with about 123 wells selling either to pipelines or to local industry. It is believed that coalbed methane could supply as much as 50% of the in-state demand for natural gas by the year 2000. This, of course, is contingent upon the development of favorable market conditions to provide incentives. At present, it appears that gas deliverability will begin to fall short of demand by the late 1980s. The coalbed methane industry in the Warrior Coal Basin would then have the necessary impetus to increase the pace of development. The Center for Economic and Business Research at The University of Alabama projects that the benefits to Alabama of a moderately paced development would include direct and indirect taxes of over $40 million, new business investments of $200 million, and direct employment increases of 5000 by 1990. 12 references, 40 figures, 56 tables.

4234 **(ERP/MRL—79-9(OP)) Evaluation of systems for early detection of spontaneous combustion in coal mines.** Chakravorty, R.N.; Woolf, R.L. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1979. vp. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

This paper briefly reviews the state-of-the-art knowledge of the methods developed and used for the early detection of spontaneous combustion. CANMET work to date on carbon monoxide monitoring and infrared detection systems is discussed. Field and laboratory studies indicate that both systems can be used successfully.

4235 **(ERP/MRL—79-81(OPJ)) Strata control instrumentation at hydraulic operation mining of a thick and steep coal seam in Western Canada.** Chiang, C.S.W.; Bannerman, W.; Fisekci, M.Y. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1979. vp. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

This paper outlines the current status of a joint study by CANMET and Kaiser Resources Ltd. on strata control instrumentation. It deals with the present state of instrumentation required for fast moving faces in an hydraulic mine where a 16 m thick and >30 degree coal seam is being extracted at Sparwood, B.C. The results at this stage are for a depth of about 300 m.

4236 **(EUR—9126-d,e,f) Roadway drivage techniques in the coal mines of the European Community.** (Graham and Trotman, London (UK)). 1984. 302p. (CONF-8311207—). European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

New developments in techniques and equipment for mine drivage are discussed. Some papers discuss specific experiences with machines in coal mines in countries of the European Community. The conference was organized into the following sessions: mechanized drivage in stone; mechanized drivage in coal; mechanization of supports; and shotfiring and loading, and mine shafts. Nineteen papers have been abstracted separately. The proceedings of the conference have also been published in German by Verlag Glueckauf, Essen, FRG, and in French by Societe de l'industrie minerale, Saint-Etienne, France.

4237 (EUR—9126-d,e,f, pp 11-41) **Roadway drivage - the changing scene.** Mills, L.J. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

This technical introductory paper sets the theme for the Symposium and touches broadly on the individual aspects of roadway drivage and shaft sinking that will be covered by subsequent technical papers. The paper indicates the continued requirement for productive and financial improvements in the context of the market for coal and its competition. It touches on the progress made in all operational spheres, but with particular emphasis on those areas of research and development which have potential for further improvement and application, and which are considered to be essential contributors to the better health of the mining industry. Particular attention is paid to new machines and systems control techniques which, with the advent of the microprocessor, provide means of obtaining precise engineering and management information and of controlling, in a consistent and automated way, operations which previously relied on a high degree of manual skill. A general concern with the reliability of equipment and systems is expressed, and the question of devising industry procedures for obtaining proper planning information and the means of acquiring proper financial outcome via life cycle costing is also discussed. The message of the paper is that, while recognising past and current achievements, we should nevertheless regard them mainly as stepping stones towards realising the potential for improvement that exists, through the application of new technologies and new techniques to production, control and financial and operational planning.

4238 (EUR—9126-d,e,f, pp 42-63) **Drivages with full-face roadheaders in the coal mines of the Federal Republic of Germany.** Hoevelhaus, H.W. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The utilisation of full-face roadheaders is becoming steadily more significant in line with the underground accessing of large adjacent seams from existing collieries. The first successful application of a full-facer in the coal industry of the FRG started in 1971. A marked upturn began after 1976, both as regards the annual distances driven and the number of full-face machines in service in the collieries of the Ruhr and Saar. A total of 7 full-facers were in service in 1982 and 1983, 3 of them with a borehead diameter of 6.5 m. However, it has not proved possible to obtain any further significant increase in the net daily drivage rate over the past 6 years. Machine types of similar design from 3 manufacturers are available; in every case they have provided convincing proof of their capacity. The first 12 years of full-face drivages have been 12 years of constant improvement in small and large steps. It was, in particular, the improvements made to points of detail in the outbye systems which brought about the breakthrough to today's big drivage performances. The focus of development over the last 4 years has been on safety improvements to the borehead in terms of maintenance and repairs, enhanced flameproofing and more effective prevention of potential gas fires. Also, crucial improvements have been made in terms of machine steering by means of laser beams and of a rapid

and uninterrupted extension of ventilating strings by means of cassette-type magazines. Particular attention has been paid to capacious and high-performing supply and clearance systems for the drivages. The costs as identified indicate that the method is very cost effective, provided that the rapid drivage of long sections of road is accepted as an indispensable component of the objective in hand.

4239 (EUR—9126-d,e,f, pp 64-76) **Robbins tunnel boring machine at Selby.** Massey, C.T. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The paper describes the large coalfield found in the Vale of York in the 1960's and illustrates the concept of working this coal with the minimum effect on the environment. The concept requires the drivage of two fifteen kilometre spine roadways across the coalfield, which are critical drivages. To improve the speed of drivage of the South Spine Roadway, and to give a better quality roadway, a Robbins Tunnel Boring Machine was installed. The special features of the machine are described and experience up to the end of May 1983 are reported in the paper.

4240 (EUR—9126-d,e,f, pp 77-90) **Deployment and technical specification of a Bouygues tunnelling machine at the Nord et Pas-de-Calais coalfield.** Blanc, A. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The management of the Nord et Pas-de-Calais coalfield have signed a contract with the Bouygues Company to drive roadways in rock to open up a new level at Arenberg cvolliery. The road will be driven with a 5 m diameter tunnelling machine designed and developed by Bouygues. This tunnelling machine is an original design and mounts only four disc cutters on 4 oscillating jibs. This mode of boring provides a number of advantages over its competitors with full-face configuration: lightness, flexibility, ease of installation and transfer. Roadway drivage is to commence early in 1984 and will last about 3 years. Envisaged daily advance rate is 10 m.

4241 (EUR—9126-d,e,f, pp 91-106) **Improvement in roadheaders.** Tregelles, P.G.; Morris, A.H. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The paper briefly describes the evolutionary progress of roadheaders in Europe from the early 1960s to the present date, in terms of development from light duty machines to a heavier generation of improved capacity and reliability. Means of improving the cutting capability of machines are discussed with particular emphasis on the application of high pressure water jets as an aid to mechanical cutting, and the provision of a stable anchored base from which boom and turret can work to provide more positive application of cutting head to the rock. A section of the paper is devoted to control technology with descriptions of the computer aided design systems for cutting heads and two of the technical information monitoring systems which are now being developed and applied. Systems design and management is touched upon, as is automation, with examples of application of these techniques to remove operator dependency and provide more consistent operation. The paper concludes with a discussion on aspects of design and new methods where a potential exists for achieving a more continuous non-cyclic operation and data acquisition for analysis and use in subsequent system and machine design.

4242 (EUR—9126-d,e,f, pp 107-119) **First operational experiences with the E200 selective roadheaders in stonedrifting.** Sander, R. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

In the West German coal industry 100 km of stonedrifts and 420 km of in-seam roads were driven in 1982. Whilst only limited use of full-face roadheaders is possible, increasing numbers of selective-cut roadheaders are being used to head in-seam roads. Since the proportion of rock being cut in drivage is increasing, the trend towards heavy types of machine is continuing. Good results achieved with selective-cut road-headers led to the decision to extend their use to stone-drifting. Taking as a basis the successful E134 Roboter built by Paurat GmbH, the E 200, weighing 115 tonnes, was developed in the context of a research project. In early 1981 the first E 200 came into service at the Rheinland Combined Mine at Bergbau AG Niederrhein and shortly thereafter another began to be used at Saarbergwerke AG's Ensdorf pit. Since then these roadheaders have driven, respectively, 1642 and 2069 metres of stonedrifts. Even though the advance rates of 4 to 8 metres per day are not entirely satisfactory, it has been demonstratd that even sandy mudstone can be cut at not unreasonable cost. Successful practical experience has led to the delivery of two further E 200s. Development work is being concentrated mainly on improving the cutting heads and raising the slewing forces when the machine is anchored. And application of metering and monitoring systems like the 'automatic pilot' successfully installed at the Rheinland Combined Mine.

4243 (EUR—9126-d,e,f, pp 120-137) **Drivage in the seam.** Harris, L. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The National Coal Board's annual programme of mining development work which last year exceeded 570 kilometres is aimed at ensuring continuity of working for the right number of longwall, shortwall, bord and pillar and single entry workings. Mechanisation of in-seam development drivage continues and there are now available machines to suit almost any roadway size or profile, in differing strata conditions. This paper describes the machines and systems currently in use.

4244 (EUR—9126-d,e,f, pp 147-160) **Use of impact rippers in the German coalmining industry.** Liesner, M.R. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The introduction of impact rippers in the West German coalmining industry some ten years ago marked the debut of a new heading technique, mainly for driving roadways in line with and behind the face. During the intervening ten years, some 50 of these machines have been used to drive 110 km of gateroads. Although the use of impact rippers was initially more common in roadways driven behind the face, the emphasis gradually shifted to roadways driven in line with the face. Roadways driven in advance of the face were always the exception. At one point, a comparative standstill appeared to have been reached in the application of this technique, but new developments may extend the impact ripper's field of application in the near future. The limits within which it is feasible to use impact rippers are relatively narrow. These machines have gained an accepted place for themselves in situations where retreat mining of roadways driven in advance of the face is impossible, and where their breaking capacity is sufficient to keep pace with the rate of face advance. First and foremost they require thinly-bedded stratified surrounding rock in the roof, and the possibility of dispensing with dinting of the floor. In roadways driven behind the face, a seam thickness of at least 1.80 m is required, whereas in roadways driven in line with the face the coal/stone ratio must be relatively favourable. Provided these requirements are met, impact rippers are cost-effective means of mechanisation in the gateroads. Additionally, in roadways driven in line with and behind the face, the impact ripper has the advantage of causing less con-

vergence, which means that the roadway cross-section can be smaller, thus reducing heading costs.

4245 (EUR—9126-d,e,f, pp 161-185) **Mechanisation of shortwall heading at Zolder Colliery in the Kempen coalfield.** Legrand, J.; Resseler, R. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

Driving gate-roads behind the coal face involves the extraction of short faces at the main-gate and tail-gate ends. At Zolder the process of mechanisation of these operations has been underway since 1967. In recent years a compact and reliable machine has been in use, which is capable of extracting both the coal and the surrounding rock in these short faces. In the Kempen coalfield this machine is used for cutting main-gate and tail-gate stables on both plough and shearer faces. The same machine can even be employed for driving rise headings and arch-supported roadways. While in all cases the coal and rock can be cut by the same machine, the installation as a whole tends to vary enormously according to the type of short face being extracted. It is certain that this machine will continue to be used for the extraction of other types of shortwall faces. One such application may be the heading of circular-section roadways where such a profile would serve to improve roadway stability and thereby allow a retreating system of working. An increase in machine output would also help extend the operating scope of this type of equipment.

4246 (EUR—9126-d,e,f, pp 186-205) **New developments in rock bolting.** Tinchon, L.; Dejean, M. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

After a brief historical survey of the introduction of rock bolting into French coal mines and of the conditions under which research was undertaken, the authors discuss the improvements made to bolts and the new types of bolt on the market which are anchored along their entire length either by friction or grouting. Virtually all the techniques currently used by the mining profession are thus covered. The authors go on to consider the development of techniques for drilling and bolt setting, laying emphasis on the research already conducted or in progress to extend the field of application of rotary drilling, which has great advantages in terms of machine dimensions, working conditions, space and noise. Finally they study the practical uses of bolting; they put forward the rules for determining bolting parameters, taking into account the nature of the strata and their classification together with the type of anchorage and its characteristics, and then they cover the ways in which bolting was actually used in the coalfields in 1982, whether as the sole means of support or as a supplement to a conventional support system.

4247 (EUR—9126-d,e,f, pp 206-221) **Use of cement products underground.** Wood, J.E. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The use of cement products underground in the U.K. is relatively limited and the paper gives some measure of experience in the North Nottinghamshire Area of the National Coal Board, where cement products have been used to solve a variety of problems. The paper briefly relates experiences with backfilling, spraying and strata replacement for support on coal faces and roadways, with shotcrete used as a sealant for spontaneous combustion prevention, with the filling of large cavities and the reduction of resistance to airflow along roadways. The appendix describes briefly the equipment and materials used.

4248 (EUR—9126-d,e,f, pp 222-241) **Linings for circular roadways.** van Duyse, H. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

In roadways driven by blasting, the use of circular linings is mainly limited to the Campine Coalfield's stone drifts where the use of prefabricated concrete segments has met with a great deal of success, in terms of both strength and cost. One important problem - to which the most satisfactory solution is currently sought - is the best method of filling the cavity between the strata and the lining. In the Campine Coalfield the cost of driving a circular roadway, 4.60 m in diameter, in virgin rock, is identical with that of driving a roadway lined with yield arch supports, of cross-section 17 m/SUP/2, in virgin rock. Then again, in roadways driven by tunneling machine a circular lining is virtually the norm. In the German collieries these roadways are lined with steel arches which take 15 to 30 min. to erect. The presence of radially-anchored gripper shoes means that at the roadhead there has to be a space of at least 75 cm between arches, which in the least favourable strata conditions requires the support to be reinforced at the roadhead either by means of strata-bolting or injection, or behind the tunnelling machine by means of extra arches or by guniting. Conditions specific to the Campine Coalfield necessitate the use of circular panel linings installed close to the roadhead, which in turn raises the crucial question of accommodating the thrust exerted at the roadhead. We chose the Bouygues tunnelling machine with a limited thrust of 120 t. At Cadley Hill colliery in Great Britain circular supports made of prefabricated concrete segments are installed at the near end of a tunneling machine shield.

4249 (EUR—9126-d,e,f, pp 242-259) **Mechanized setting of roadway supports.** Reiff, W. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

Almost 40% of the 700 and more roadways being driven in West German coal mines feature mechanical systems for setting the arch supports. This report presents a survey of the various types of support-setting equipment used for individual heading techniques. In shotfired drivages one still finds a predominance of power-driven working platforms which, as roadway profiles increase, represent a considerable step forward in terms of safety and the sequence of work. Multi-purpose platforms have established themselves as the pinnacle of mechanized arch setting. These platforms can transport and set a fully-assembled crown section, undertake forepoling and provide effective protection at the heading face. The mechanized systems available for roadheaders range from the simple boom-mounted arch-setter to the self-advancing roadhead support frame and roadway heading shield. In full-face drivages mechanized systems are employed to set and hydraulically tension complete ring segments, usually without the need for backfilling.

4250 (EUR—9126-d,e,f, pp 260-271) **Recent developments in drilling techniques.** Delcruzel, J. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

Conventional rotary drilling is well enough suited to relatively soft and non-abrasive rock. But for rocks having a high degree of hardness and abrasivity, conventional rotary drilling is inadequate and one has to resort to rotary-percussive drilling, a mode which has many drawbacks, especially relating to working conditions. In order to extend the range of application of rotary drilling, two directions have been marked out: drilling with diamond bits; drilling backed with high-pressure water jets. Drilling tests with diamond bits have shown relatively high drilling speeds to be feasible in abrasive rock, but the high cost of the bits and their fragility in disparate rock do not hold out the prospect of extensive development in this type of equipment. Drilling assisted by high-pressure

water jets has given remarkable results in CERCHAR laboratories in both hard and abrasive rock. The equipment already developed has a high reliability which makes for cost-effective employment underground. One such installation is being brought into service at the Nord et Pas-de-Calais coalfield.

4251 (EUR—9126-d,e,f, pp 272-282) **Use of trackless vehicles in roadway drivage in the Aquitaine Coalfield.** Blanc, M. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

Twelve years after the introduction of trackless vehicles in the Aquitaine Coalfield, this paper provides a survey of their use in the field of roadway drivage. Various parameters relating to the operation of LHD's are discussed (production curves, maximum permissible elongation, etc.). The mechanised materials transport chain, which is based on the use of specialised Diesel vehicles throughout, is also described.

4252 (EUR—9126-d,e,f, pp 283-294) **Loading out of stone in annular panels.** Claes, C. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The horizontal main stone drifts in the Campine coal basin are lined during driving operations with standardized circular concrete panels. The drifts contain a double set of rail tracks for mine tubs. In view of the requirements thus imposed, the loading of debris was until 1980 carried out exclusively using track-mounted shovel loaders. Although results in terms of production costs and output were satisfactory, greater daily advances were desirable. However, the constantly increasing distances to shafts and shorter working hours impaired output and shortened the drivage cycle. From 1980, therefore, studies and tests were carried out in order, among other things, to shorten the important phase of rock loading in the drivage cycle. Heavier track-mounted shovel loaders were used, with caterpillar track grab loaders being operated at certain faces. This report gives a general outline of the installation of the equipment and of the organization of the drivage cycle. The potential, improvement, advantages and drawbacks of the loading systems are also discussed.

4253 (EUR—9126-d,e,f, pp 295-306) **Latest developments in shaft construction technology.** Riess, H.G. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

The vertical, surface-connected shaft will, in future, remain the artery of a colliery. Its necessity as regards layout underground, manriding, transport and, of course, ventilation remains unchallenged. Progress in the construction of surface-connected shafts has been one of the reasons behind the upturn in the meters of shaft sunk per year in the West German coal mining industry. Heavier-duty sinking equipment, new ways of mechanically breaking the strata and the perfecting of shaft lining techniques have all played their part. Aspects of shaft construction techniques of the future and their requirements are being studied in project-related RandD programmes.

4254 (EUR—9126-d,e,f, pp 307-318) **Comparison - shafts versus drifts.** Stephenson, D.J. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

This paper gives a brief history of shafts and drifts as means of accessing coal measures, and describes the merits of each from the point of view of safety, geology and transport. The effects of modern technology and environmental considerations on the choice between the two methods are examined, the equipment available for each is described, and the costs of the two systems are compared.

4255 (PB—84-220177) **Subsidence over a room-and-pillar coal panel in southern West Virginia. Open file report 7 May 1982-28 October 1983.** Jones, T.Z.; Kohli, K.K. (West Virginia Inst. of Tech., Montgomery (USA). Div. of Mining). Sep 1983. 78p. NTIS, PC A05/MF A01.

This study was sponsored by the Bureau of Mines as part of its on-going subsidence research program. The study involved installation of surface survey monuments over a room-and-pillar panel in southern West Virginia, eastern coal province. Monitoring was conducted for a period of 6 months. Maximum subsidence was 1.48 ft and occurred near the center of a two-panel span, one of which was monitored as part of the study and the other adjacent to it. This is equal to 31 pct of the extracted coal height. The angle of draw over the pillared panels was 24 degrees. The width-to-depth ratio over the pillared panels was 0.85. A maximum surface horizontal strain of 0.003 was detected near the center of the monitored panel. The overburden lithology consists of interlayered sandstone, shales, and coal with 50 pct of the overburden being sandstone layers 5 ft thick or greater.

4256 (PB—84-220664) **Development and evaluation of near-mine stimulation techniques for coalbed degasification. Open file report 29 September 1980-1 March 1984.** Murrie, G.W.; Popp, J.T.; McCulloch, C.M.; Steele, D.J. (Dames and Moore, Cincinnati, OH (USA)). May 1984. 127p. NTIS, PC A07/MF A01.

The purpose of this project was to determine the effects of foam stimulation treatments upon mining conditions in underground coal mines. Underground investigations were conducted to characterize the geological and mining conditions both before and after the holes were stimulated. Of 12 holes that were drilled at mine sites in Kentucky, Pennsylvania, Utah, and West Virginia, 4 were mined through and mining progressed within 75 ft of a fifth before mining plans were altered because of unassociated reasons. The fracture fluids were tagged with fluorescing paint pigments to enable their underground pathways to be detected with an ultraviolet light and accurately mapped. At the holes that were intercepted by mining, the induced fractures were all contained within the coal seams. Horizontal fracturing at the seam-roof interface and along an in-seam binder was more extensive than vertical fracturing, which was confined primarily to the more friable portion of the seam.

4257 (PB—84-222413) **Environmental protection in the Federal coal leasing program.** (Office of Technology Assessment (U.S. Congress), Washington, DC). May 1984. 162p. (OTA-E—237). NTIS, PC A08/MF A01.

Library of Congress catalog card No. 84-601068.

The basic framework of the Federal coal leasing program - the legislative mandates and the concept of a tiered structure of land use planning, activity planning and mine permitting - is still workable and capable of ensuring environmental protection. Recent policy shifts accelerated the rate at which tracts were made available for lease, and other changes have been made in the Federal coal leasing program regulations. Although not producing any evidence of 'fatal flaws' that would totally preclude mine development on recently leased tracts, these changes have increased the risk of adverse environmental impacts if some of those tracts are developed. An environmentally, (and economically) sound leasing program is an important part of our energy future and of public land management policy. Unless reasonable public expectations about 'soundness' are satisfied, OTA concludes that the likelihood of an effective and predictable Federal coal leasing program will be reduced.

4258 (PB—84-225184) **Conservation and development in-house and contract research in fiscal year 1984 (Bureau of Mines). Information circular.** (Bureau of Mines, Washington, DC (USA)). 1984. 27p. (BM-IC—8982). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-9507.

This publication summarizes the in-house and contract research projects programmed for fiscal year 1984 by the Bureau of Mines under its Conservation and Development activity. The document provides a mechanism for interested parties to gain insight into projects of the Bureau's Conservation and Development research program. The objective of the Conservation and Development Program is to provide the technological advances needed to stimulate the mining of domestic deposits containing critical, strategic, and other essential minerals in compliance with existing regulations and at costs sufficiently low to be competitive in world markets. Research efforts are directed toward improving the fundamental understanding of processes and procedures involved in the production of minerals. The overall goals will be accomplished by investigating alternative mining methods to increase domestic production of critical and strategic minerals from low-grade deposits; expanding the technology for the economic and efficient extraction of minerals consistent with cost-effective compliance with environmental regulations; and advancing the technologies needed to insure an adequate supply of coal.

4259 **(PB—84-225903) Simulation of methane flows in noncoal mines. Report of investigations/1984.** Cecala, A.B.; Thimons, E.D. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1984. 16p. (BM-RI—8880). NTIS, PC A02/MF A01.

Library of Congress catalog card No. 84-600027.

The Bureau of Mines has successfully tested a method to simulate methane (CH4) flows from face areas through the returns of noncoal mines. This technique involves releasing a small quantity of tracer gas at a working area and sampling for that gas downstream in the return airways. By measuring the dilution of the tracer gas, the dilution of any volume of CH4 released at the face can be calculated. This information is useful in selecting locations for CH4 monitors and in deciding the necessity for permissible equipment in the returns.

4260 **(PB—84-235282) Influence of overlying strata on methane emissions in a northern West Virginia coal mine. Report of investigations/1984.** Ulery, J.P.; Molinda, G.M. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). 1984. 21p. (BM-RI—8879). NTIS, PC A02/MF A01.

Library of Congress catalog card No. 84-600029. Sponsored in part by Bureau of Mines, Washington, DC.

Since 1970, abnormally high methane emissions have been observed in eastern sections of the Federal No. 2 Mine operating in the Pittsburgh Coalbed in northern West Virginia. The nature and volume of these emissions indicate a source other than the coalbed. An investigation was undertaken to delineate probable methane sources. Gas well information and stratigraphic correlation of corehole data indicates that a sandstone directly above the main coalbed is an additional source of methane emissions. The sandstone body appears to be an ancient stream channel, infilled with fine-grained sand and organic matter. Coalification of the organic matter produced methane as a byproduct. Additional methane presumably migrated into the sandstone unit from the subjacent coalbeds. The methane became trapped in the porous clastic unit by the surrounding impermeable strata. Mine development near this unit creates a significant pressure gradient, triggering abnormal methane emissions into the mine along naturally occurring fractures. Predevelopment methane drainage of the sandstone could be accomplished by completing vertical boreholes along its trend.

4261 **(PB—84-239151) Monitoring and control of mine air diesel pollutants: tailpipe emissions measurements, aftertreatment device evaluation and quantification of diesel and coal fractions of particulate matter with raman spectroscopy. Open file report.** Johnson, J.H.; Carlson, D.H.; Osborne, M.D.; Reinbold, E.O.; Cornilsen, B.C. (Michigan Technological Univ., Houghton (USA)). 15 Nov 1982. 182p. NTIS, PC A09/MF A01.

See also PB82-148388.

The objective of this research was to provide engineering guidelines and methodologies for the control of air quality in dieselized underground mines. The work includes investigations of the interrelationship between ventilation and diesel operational and control parameters, develops measurement technology and methods, and evaluates emission control devices specific to the operation of diesels in deadend entries. The report includes a description of the emissions measurement apparatus, monitoring methods and evaluation, evaluation of on-board CO2 monitors, selective analysis for diesel soot in coal mine dust samples, exhaust control techniques using a mine air quality laboratory, and technical papers.

4262 **(HSE-Trans—7274) Non-stationary ventilation conditions with open mine fires.** Trutwin, W. (Safety in Mines Research Establishment, Sheffield (UK); Polska Akademia Nauk, Krakow). Sep 1977. Translation source information not available . (CONF-7710198—3-Trans.). 7p. NTIS (US Sales Only), PC A02. File Number DE84901842.

From 17. international conference of mining safety research; Varna, Bulgaria (3 Oct 1977).

Open mine fires lead to the occurrence, in non-horizontal ventilation roads, of a driving effect, which for ascensional ventilation leads to an increase, and for descensional ventilation to a decrease, in the amount of ventilation. From this it follows that with descensional ventilation one can speak of an opposing effect. An appropriate magnitude of the opposing effect can cause a ventilation reversal. From the safety point of view the case of a mine fire with descensional ventilation is of the most interest, as it can lead to the greatest effects on the ventilation in the whole mine network. The consequences of open mine fires with descensional ventilation have, as opposed to ascensional ventilation, a specific time relationship, which arises from the dynamics of the fire as well as from the ventilation in the whole mining network: (1) The first phase involves the condition from the beginning up to the stopping of the ventilation flow. In this time period the opposing drive increases to a given value, which depends on the intensity of the fire. (2) After this, follows a condition of equilibrium in which the ventilation flow is either zero, oscillates about this value, or, rather quickly, a ventilation reversal occurs. This condition is to be treated as a typical unstable equilibrium state of the ventilation and fire processes. A disturbance must exceed a given value in order to bring the dynamic system out of the unstable equilibrium condition and lead to a stable ventilation reversal. (3) The third phase involves the time period after the stable ventilation reversal. This condition depends only on the magnitude of the opposing drive. As we can see from the above considerations, an assessment of the change of condition resulting from open mine fires, with descensional ventilation, is very difficult.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 0130004184, 4185, 4186, 4266

4263 **(ERP/MSL—79-80(OP)) Desulphurization and deashing of an Eastern coal by high-gradient magnetic separation.** Mathieu, G.I. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1979. vp. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

Tests were performed on a raw coal from the Prince mine of Cape Breton Development Corporation using the high-gradient magnetic separation (HGMS) process. The sample contained 9.26% ash and 2.56% pyritic sulphur of which up to 57.4% and 65.4%, respectively, were removed by HGMS. Tests are described along with the characteristics of the coal sample and features of the magnetic separator.

0140 Combustion

4264 **(ECN—83-045) Fluidization characterization in gas-fluidized beds.** van der Borg, N.J.C.M.; Beesteheerde, J. (Netherlands Energy Research Foundation, Petten). Mar 1983. 18p. (In Dutch). Netherlands Energy Research Foundation, Petten.

Research on heat transfer and hydrodynamics in a fluidized bed requires an experimental procedure to characterize the fluidization pattern. This report describes the first stage in the development of a method for detecting local fluidization and for measuring the dynamical bed-height and bubble properties (velocity, frequency and volume). The method has been tested using 2-dimensional

models (cold and hot) in combination with a high speed camera as well as in a small coal fired fluidized bed combustor. As fluidization detectors, sheathed thermocouples have been used which were kept at a temperature different from that of the fluidized bed. The difference in the heat transfer between the thermocouples and the dense phase on the one hand and the bubble phase on the other, induces variations in the thermocouple temperature. Using the mean value of the temperature and the temperature variations, the desired information can be obtained. The thermocouple voltage data were stored because a flexible data treatment was desired during the stage of development. Subsequently the data have been treated numerically. It is expected, however, that the relevant information can also be obtained using hardware instruments (AC-amplifier, differentiator, recorder and correlator). (In Dutch)

4265 **(ERP/ERL—80-25(OP)) Coal combustion activities of the Canadian Combustion Research Laboratory.** Lee, G.K.; Friedrich, F.D.; Whaley, H.; Ogle, I.C. (Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). 1980. vp. Canada Centre for Mineral and Energy Technology, Ottawa, Ontario.

Brief descriptions are given of projects of the Canadian Combustion Research Laboratory (CCRL) of CANMET related to improved utilization of coal in conventional pulverized-fired boilers and kilns, the use of coal-oil mixtures as a substitute fuel in equipment designed for oil firing and efforts to accelerate the application of fluidized-bed combustion systems for low-grade coal.

4266 **(PB—166815) De-ashed coal combustion study, May-October 1964. Final report.** Frey, D.J. (Combustion Engineering, Inc., Windsor, CT (USA). Kreisinger Development Lab.). 1964. 19p. NTIS, PC A02. File Number TI84901912.

Combustion Engineering, Inc. has been contracted by the Office of Coal Research to evaluate the burning characteristics of a low-ash coal. In essence, the base coal is dissolved in a solvent, filtered to remove most of the ash, and then heated to recover a portion of the solvent. The physical properties of the de-ashed coal can be altered depending on the amount of solvent left in the coal. The de-ashed coal was fired in existing test equipment in both its solid and liquid states, using commercially acceptable procedures for firing heavy oils and pulverized coals. Thus the study also entailed an evaluation of handling and control systems. Procedures, results and recommendations are presented. 7 figures, 2 tables.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 0150004204, 4233, 4237

0160 Health And Safety

REFER ALSO TO CITATION(S) 0160004259, 4262, 5078

4267 **(CONF-8410190—1) Use of health effect risk estimates and uncertainty in formal regulatory proceedings: a case study involving atmospheric particulates.** Habegger, L.J.; Oezkaynak, A.H. (Argonne National Lab., IL (USA); Harvard Univ., Cambridge, MA (USA)). 1984. Contract W-31-109-ENG-38. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002727.

From Annual meeting of the Society for Risk Analysis; Knoxville, TN, USA (1 Oct 1984).

Coal combustion particulates are released to the atmosphere by power plants supplying electrical to the nuclear fuel cycle. This paper presents estimates of the public health risks associated with the release of these particulates at a rate associated with the annual nuclear fuel production requirements for a nuclear power plan. Utilization of these risk assessments as a new component in the formal evaluation of total risks from nuclear power plants is discussed. 23 references, 3 tables.

4268 **(NR—83/59) Toxicity research of fly ash samples from a pulverized coal fired installation.** Adema, D.M.M. (Nijverheidsorganisatie TNO, Delft (Netherlands). Hoofdgroep Maatschappelijke Technologie). Apr 1983. 26p. (In Dutch). Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands.

Toxic properties of two samples of fly ash from a pulverized coal fired boiler in the Netherlands were determined. The samples were taken from the electrostatic filters. Toxic effects were determined using crustaceans and some plants. Toxic effects observed were possibly caused by the combination of boron, vanadium, chromium and/or fluorides. (In Dutch)

4269 **(EUR—9151-EN,DA,DE,FR,IT,NL) 19th report of the Safety and Health Commission for the mining and other extractive industries.** (Commission of the European Communities, Luxembourg). 1981. 268p. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037.

Following an outline of statistical aspects of the coal economy in 1981, this report presents details of the general activities of the Safety and Health Commission, activities of the Working Parties, some common accident statistics, and statistical tables for the extractive industries other than the coal industry. Annexes to the report provide information on terms of reference of the mines safety commission and the working parties, composition of the commission and working parties, studies completed since 1976, and a proposal to governments for control of offshore welldrilling and training of personnel in charge of well operations.

4270 **(HSE-Trans—7294) Arcs in group I flameproof enclosures.** Skorja, K. (Elektrotehnicki Institut Rade Koncar, Zagreb (Yugoslavia)). 27 Mar 1979. Translation source information not available . (CONF-7710198—4-Trans.). 9p. NTIS (US Sales Only), PC A02. File Number DE85900056.

From 17. international conference of mining safety research; Varna, Bulgaria (3 Oct 1977).

In this report, research on high-power arcs in flameproof enclosures, designed for mines, is described. Consequences of high-power arcs in the melting of the enclosure wall, the increased temperature of the enclosure, and destruction of the enclosure as a result of pressure caused by head from the arc as well as by the gases produced by decomposition of organic materials are also addressed. 12 references, 8 figures. (DMC)

4271 **(HSE-Trans—7270) Safe methods of regulating the ventilation in gassy mines.** Puchkov, L.A. (Health and Safety Commission, London (UK)). Sep 1977. Translated from 17th Int. Conf. Directors of Safety in Mines Research, Varna, Bulgaria, Oct. 1977, Paper E7. (CONF-7710198—2-Trans.). 12p. NTIS (US Sales Only), PC A02. File Number TI84901841.

From 17. international conference of mining safety research; Varna, Bulgaria (3 Oct 1977).

The basic problem of operational regulation of the air flow rate in extraction districts in gassy mines is defined by a complex interrelationship of the processes of ventilation of the district and the gas discharge from the worked areas. A method of regulation was developed which would ensure the necessary operativeness of the ventilation system control, while excluding any possibility of dangerous gas concentration. 4 references, 6 figures. (ACR)

0170 Legislation And Regulations

4272 **(DOE/MC/19334—1693) Development potential of coalbed methane in the Warrior Coal Basin of Alabama (Chapters 4, 5, and 6).** (Alabama Univ., University (USA). School of Mines and Energy Development). May 1984. Contract AC21-82MC19334. 303p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85003302.

Coalbed methane gas has significant potential as an alternate energy source. The commercial development of coalbed methane actually began in the early 1930's. However, recently the increased commercial potential for coalbed gas exploitation has resulted in legal questions over ownership. Legal issues could be the biggest

stumbling block to the development of coalbed gas. The latest methane gas ownership decision, Hoge v. US Steel Corp., 468 A2d 1380 (Pa 1983), grants methane gas rights to the owner of coal rights. Earlier decisions in the Hoge case granted coalbed methane rights to the natural gas lessee. The conveyance in Hoge only used the general term gas. Use of such ambiguous conveyances is expected to lead to more litigation. Courts in such cases attempt to ascertain the intent of the parties to the conveyance. Conventional oil and gas and hard mineral leases should be modified to be used for methane conveyances. Any conveyance must take into account the existence of any coalbed methane production regulations, such as those approved by the Alabama State Oil and Gas Board in 1984. Such controls may be authorized under oil and gas conservation statutes or mining regulations. Several states have addressed the issues of ownership or use of conflict through statutory provisions. Federal pollution laws covering discharges into federal or state waters may be inforced against methane operations. The most important policy consideration for coalbed methane development should be the timely and efficient development of energy resources with a minimum of environmental degradation. One approach to this problem would be a statute enabling a commission or board to handle conflicts between various natural resource developers, to avoid litigation and attain overall perspective on resource development. 35 references, 18 figures, 23 tables.

02 PETROLEUM

0201 Reserves

4273 **(OCS/MMS—84-0024) Estimated oil and gas reserves Southern California Outer Continental Shelf, December 31, 1983.** Wolfson, S.A. (Minerals Management Service, Los Angeles, CA (USA). Pacific OCS Region). 1984. 10p. Minerals Management Service, 1340 W. 6th Street, Los Angeles, CA 90017. File Number TI85900376.

Remaining recoverable reserves of oil and gas in the Outer Continental Shelf off Southern California are estimated to be 1153 million barrels of oil and 2141 billion cubic feet of gas. The estimates for both the remaining and the original recoverable reserves of oil and gas are higher than the corresponding estimates for December 31, 1982. Reserve estimates for 18 fields were based on individual volumetric reservoir studies. Decline-curve and volumetric analyses were used for the remaining two fields. At the end of 1983, seven fields were on production. 5 references, 2 figures, 1 table.

4274 **(USGS-CIRC—922-A) Assessment of undiscovered conventionally recoverable petroleum resources of the northwest European region.** Masters, C.D.; Klemme, H.D. (Geological Survey, Alexandria, VA (USA)). 1984. 28p. US Geological Survey, 604 South Pickett St., Alexandria, VA 22304. File Number TI85900365.

The estimates of undiscovered conventionally recoverable petroleum resources in the northwest European region at probability levels of 95 percent, 5 percent, statistical mean, and mode are for oil (in billions of barrels): 9, 34, 20, and 15; and for gas (in trillions of cubic feet): 92, 258, 167, and 162. The occurrence of petroleum can be accounted for in two distinct geological plays located in the various subbasins of the region. Play I is associated with the distribution of mature source rocks of Late Jurassic age relative to four distinct trapping conditions. The play has been demonstrated productive mostly in the Viking and Central Grabens of the North Sea, where the shale has been buried to optimum depths for the generation of both oil and gas. To the north of 62°N. latitude up to the Barents Sea, source rocks become increasingly deeply buried and are interpreted to be dominantly gas prone; a narrow band of potentially oil-prone shales tracks most of the coast of Norway, but water depths in favorable localities commonly range from 600 to 1200 feet. To the south of the Central Graben, the Jurassic source rocks are either immature or minimally productive because of a change in facies. Undrilled traps remain within the favorable source-rock area, and exploration will continue to challenge the boundaries of conventional wisdom, especially on the Norwegian side where little has been reported on the geology of the adjoining Bergen High or Honda Basin. Play II is associated with the distribution of a coal facies of Carboniferous age that is mature for the generation of gas and locally underlies favorable reservoir and sealing rocks. The play is limited largely by facies development to the present area of discovery and production but is limited as well to the southeast into onshore Netherlands and Germany by the unfavorable economics of an increasing nitrogen content in the gas. 11 references, 26 figures, 3 tables.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 0202004274, 5589

4275 **(N—84-28192) Symposium proceedings: a national program for the assessment and development of the mineral resources of the United States Exclusive Economic Zone.** (Geological Survey, Reston, VA (USA)). 1984. 302p. (LC—84-601040). NTIS, PC A14/MF A01.

Offshore crude oil, natural gas, and mineral resources within the United States Exclusive Economic Zone were considered from the standpoint of hydrogeology. The status of marine technology available for mining and oil and gas exploration is reviewed. For individual titles, see N84-28193 through N84-28197.

4276 **(N—84-28193) Chapter 6: the US Geological Survey program and plans in the EEZ.** Peck, D.L. (Geological Survey, Reston, VA (USA)). 1984. 27p. NTIS, PC A14/MF A01.

Hydrogeology programs of the U.S. Geological Survey (USGS) within the Exclusive Economic Zone (EEZ) of the United States are reviewed. Mineral deposits in the sea floor and offshore energy sources such as oil and natural gas are discussed.

4277 **(N—84-28194) Panel 1A: geologic studies related to oil and gas development in the EEZ.** Klitgord, K.D.; Watkins, J.S. (Geological Survey, Woods Hole, MA (USA)). 1984. 78p. NTIS, PC A14/MF A01.

Offshore crude oil and natural gas resources within the United States Exclusive Economic Zone are discussed from the standpoint of hydrogeology. Four major offshore areas--East Coast Atlantic, Gulf of Mexico, West Coast Pacific, and Alaska--were considered. The general geologic/tectonic settings of the four regions were outlined. The research directions required for the assessment of the resource potential were examined, and the hazards associated with resource development were discussed.

4278 **(PB—84-231208) Applications of remote sensing techniques to oceanography and sea ice.** Thoren, R. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Apr 1984. 16p. (FOA-B—60004-M7). NTIS, PC E03/MF E01.

Summaries in English and Swedish.

The author describes different methods for satisfactory position-fixing and navigation in and under sea ice, all of great importance for exploration and transportation of natural resources, such as oil, gas and minerals, and he emphasizes the importance of a true knowledge of the bottom topography. In chapter (2) he gives information concerning the activity of 'The Swedish National Defence Research Institute' in the civil field and technical advances in the submarine/diving area, seismology, and hydroacoustic/optic integrated system for navigation in Arctic waters. Chapter (3) deals with offshore activities, chapter (4) with cargo submarines and LNG submarine tankers, chapter (5) with viewpoints on radio communication systems and submarines operating under ice. Chapter (6) deals with 'Swedish Space Corporation and Esrange-activities', chapter (7), finally, with plate tectonics and technology of deep ocean mining.

4279 **Facies relationships and reservoir potential of Ohio Creek interval across Piceance Creek basin, northwestern Colorado.** Rutledge, A.K.; Lorenz, J.C. (Sandia National Laboratories, Albuquerque, NM). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 4, 524(Apr 1984). (CONF-8405216—).

From AAPG annual convention; San Antonio, TX, USA (20 May 1984).

The Ohio Creek member of the Mesaverde Group of Late Cretaceous age grades from a fluvial to a paralic facies from the southern to central parts of the Piceance Creek basin. The Ohio Creek is considered here to be the nonmarine to paralic equivalent of the Lewis transgression to the north. Although it is fluvial in the type area and southern part of the basin, evidence of marine influence in the east central part of the basin includes: (1) zones of abundant logs with large fossil Teredinidae burrows, (2) palynological evidence from outcrops at Rifle Gap and the US Department of Energy MWX wells, and (3) marine-type sedimentary structures visible in outcrop. In this east-central area Ohio Creek depositional environments are interpreted as distributary channel and estuarine. Although the Ohio Creek is highly altered by diagenesis and is an aquifer in some parts of the basin, the equivalent zones are productive of hydrocarbons in the north-central parts of the basin. Continued changes in facies toward a marine environment to the north affected the petrologic characteristics and sand body/reservoir morphology, increasing the reservoir potential of this zone to the north. The variably thick interval is recognizable in the subsurface as an extensive sandy zone with blocky shaped log profiles; it should provide good reservoirs where porosity and permeability are not occluded by diagenesis, and where continuity with surface exposures has not allowed gas escape and water influx.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 0203004273, 4292, 6239

4280 **(AEEW-R—1698) Investigation of methods of performing flash calculations for two-phase reservoir fluid systems.** Smith, C.M.; Rodwell, W.R. (UKAEA Atomic Energy Establishment, Winfrith). Mar 1983. 33p. Winfrith Secretariat, AEEW Dorchester, Dorset, England. File Number TI85900211.

Methods of performing flash calculations for multi-component fluid mixtures are reviewed and compared. The main comparison is between Newton-Raphson and successive substitution algorithms applied to systems containing limited numbers of components, such as are typically used in compositional simulations. Some unconventional approaches to carrying out flash calculations are also investigated. The established methods are found to be more efficient than the novel methods, but the relative merits of the Newton-Raphson and successive substitution approaches are found to be case dependent. The utility of a test for determining the number of phases present in a system is evaluated. 7 references, 3 tables.

4281 **(DOE/BPO—84/2) Contracts for field projects and supporting research on enhanced oil recovery. Progress review No. 38, quarter ending March 31, 1984.** Linville, B. (ed.). (USDOE Bartlesville Project Office, OK (USA)). Oct 1984. 95p. NTIS, PC A05/MF A01; GPO Dep. File Number DE84012728.

Progress reports are presented for the following: (1) chemical flooding (field projects, supporting research); (2) gas displacement (field projects, supporting research); (3) thermal methods (field projects, supporting research); (4) resource assessment technology; (5) extraction technology; and (6) microbial enhanced oil recovery. (ATT)

4282 **(N—84-28196) Panel 2A: offshore oil and gas technology assessment.** Crooke, R.C.; Otteman, L.G. (Global Marine Development, Inc., Irvine, CA (USA)). 1984. 37p. NTIS, PC A14/MF A01.

The status of offshore oil and natural gas technology is reviewed, particularly as it pertains to deepwater and Arctic frontier areas of the U.S. Outer Continental Shelf. Offshore platforms, pipelines, tanker loading systems, and subsea support systems are discussed. Research and development activities of the petroleum industry, the U.S. Government, and the governments around the North Sea are briefly discussed.

4283 **(NIPER—21-Vol.1) Energy production research. Volume I. Monthly progress report, October 1984.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 15 Nov 1984. Contract FC01-83FE60149. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002969.

Project research summaries are presented for the following: (1) geoscience application to the prediction of reservoir variations; (2) reservoir screening and recovery predictions; (3) EOR environmental compatibility; (4) development of improved oil mobilization concepts; (5) gas miscible displacement method; (6) mobility control mechanisms of steamflooding additives; (7) improvements in stimulation technology; (8) steamflooding with additives; (9) recovery processes - chemical; and (10) development of improved immiscible gas displacement methodology. (ATT)

4284 **(NP—5900400) Effect of temperature, fluid composition, and flow rate on sandstones: implications for enhanced oil recovery methods. Final report for 1983/1984 SOMED project.** Donahoe, R.J. (Alabama Univ., University (USA). Dept. of Geology). Sep 1984. 18p. SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486. File Number TI85900400.

The goal of this project is to develop, through experimentation and computer modelling, a predictive model for fluid injection enhanced oil recovery methods. Such a model will make possible accurate risk assessment before fluid injection programs are implemented, and therefore help to prevent costly field trial and error. The specific objectives of this study are to: (1) establish the experimental and computational facilities needed to conduct the remaining project objectives, (2) carry out a series of flow-through experiments, collecting data on the effect of T, flow rate, and fluid/solid composition on sample permeability and mineralogy, (3) develop a predictive geochemical model for mineral reactions which affect reservoir permeability, and (4) test the accuracy of the model using case histories and field tests. The first objective was scheduled for completion during the first project period (2/1/84 through 8/15/84). The tasks for the first project period are discussed in terms of their results and their status with respect to the original project task schedule. All project tasks scheduled for the first year have been completed on or ahead of schedule, with the exception of the testing of the flow-through system. This task will be completed shortly and the experimental portion of the project (objective 2) will soon be underway. 4 references, 1 figure.

4285 **EOR databank assembled.** Ray, R.M. *Northeast Oil Reporter;* 1: No. 9, 83-86(Oct 1981).

Enhanced oil recovery (EOR) technology has progressed rapidly in the last few years, and a unique situation is now at hand. The Bartlesville Energy Technology Center (BETC) of the Department of Energy has supported research to survey and collect existing, publicly available data on oil reservoirs, to indentify those reservoirs amendable to EOR technology. The data from these efforts act as a broad base from which simplified models may be derived to predict the amounts of oil reserves technically and economically recoverable by EOR techniques. BETC also has been involved in 2 programs related to EOR technology - the enhanced oil recovery cost-sharing program, and the tertiary incentive crude oil program. These 2 programs have achieved the largest accumulation of data on EOR projects assembled in one place. The data will be used to improve the predictability of the simplified models; this improved predictability, it is hoped, will promote more widespread use for EOR technology and eventually reduce the risk involved in applying this technology to new areas such as the Northeast.

0204 Processing

4286 **(NIPER—21-Vol.2) Processing and thermodynamics research. Volume II. Monthly progress report, October 1984.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 15 Nov 1984. Contract FC01-83FE60149. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003126.

A detailed list of materials was prepared, data and information that will be gathered for analysis in the study (Project BPT1)

that relates feedstock to product slate. A meeting of the sponsors Steering Committee gave broad support to the research direction presented. Discussions were held with Professor Lloyd Lee at the University of Oklahoma on possible future cooperation of this work with his correlation and model studies. Mass spectrometry efforts (Project BPT2) centered on establishing the performance characteristics of the MS-50 as pertains to quantitative ultra-high dynamic resolution low voltage EI analysis with this system. A complete review of all chemical separations done to date on Wilmington and Mayan crudes revealed a few inconsistencies, and a few repeat experiments are in progress to resolve them (Project OPT2). Preparations are being made for thiophene separations from the 425° to 550°C Cerro Negro neutrals (Project OPT2). A review of the progress on the chemistry of contaminated fuels project (Project OPT4) was held with DOD personnel. The acid fractions of the various distillates from contaminated diesel fuel have been shown to be corrosive in copper strip testing. Biological activity was also established as one source of corrosion problems. Stability test technique development focused on the type of filter materials that will withstand the accelerated aging conditions (65°C) for several weeks. Thermodynamic studies on hetero-atom compounds continued with experimental work in progress on 2,5-dimethylpyridine, 2,5-dimethylpyrrole, 2,3-benzofuran, and 3-methylpyrrolidine (Project BPT3A and BPT3B). Vapor liquid-equilibria measurements continue on hydrogen and a 450° to 950°F cut from the Wilsonville, AL coal liquefaction plant (Project OPT3).

0207 Marketing And Economics

4287 **(CONF-8312101—1) OPEC: market dominant or subservient.** Simyar, F. (Ottawa Univ., Ontario (Canada)). 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85900278.

From Annual meeting of the Academy of International Business; San Francisco, CA, USA (27 Dec 1983).

The purpose of this paper is to study the role of OPEC as market dominant or subservient. One of the principal themes of this paper is to demonstrate the fallacy of one of the popular current beliefs: that it is OPEC who initiates policies regarding petroleum (prices, production levels, etc.), that OPEC is the principal beneficiary of such policies, and that it is the western, non-OPEC oil producing nations along with the major oil companies who react to OPEC policies. The paper concludes that in many instances, OPEC was very much a follower and not an initiator; adopting the policies that were initiated by the major non-OPEC producers or the major oil companies or by both. In order to prove this hypothesis, the paper first reviews the major oil crises after World War II, particularly the 1978-1979 crisis, and examines the nature of the superpowers' as well as the oil companies' involvement, both direct and indirect, in these crises. Next, the analysis focuses on the real beneficiaries of these crises and, finally, the paper concludes with a synthesis of OPEC's role in the light of the analysis presented here. 8 references, 13 figures, 1 table.

4288 **(DOE/CS/56050—1) Impacts of alcohol fuels utilization on US refinery operations.** (Mueller Associates, Inc., Baltimore, MD (USA)). Sep 1984. Contract AC05-79CS56050. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002859.

The impacts of widespread commercialization of alcohol fuels on the US petroleum refining industry are explained and discussed based on assumptions of 10% displacement of petroleum fuels by alcohol either neat or in blends. Both methanol and ethanol alcohol fuels are assessed with respect to their effects on refinery economics, energy consumption, crude oil savings, and health and safety considerations. Industry-wide response to, and impacts resulting from, alcohol use are evaluated along with the impacts on certain typical refining situations comprising the industry. 1 reference, 3 figures, 21 tables.

4289 **(OCS/MMS—84-0050) Atlantic index, June 1983-May 1984.** Collignon, M.A. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). 1984. 115p. OCS Information Program, 12203 Sunrise Valley Drive, Reston, VA 22091. File Number TI85900313.

Chapter 1 describes the offshore leasing process from a national perspective and discusses the 5-year leasing program. Also presented is information on the July 1982 final 5-year Outer Continental Shelf (OCS) oil-and-gas leasing schedule and the tentative milestones schedule issued subsequent to the July 1982 schedule. Chapter 2 chronicles the oil- and gas-related history of the Atlantic OCS Region from June 1983 to May 1984. Chapter 3 describes the steps in the pre- and postlease processes. It also includes the new prelease procedures, such as the call for information and area identification. Relevant documents produced from June 1983 through May 1984 are listed by lease sale or offering for each step. Chapter 4 reports the MMS programs that support the offshore leasing process. The appendixes include directories of federal and state offshore-related contacts and other information pertinent to the OCS leasing process. Maps are presented showing locations of the three planning areas in the Atlantic OCS region. 6 figures, 18 tables.

0208 Waste Management

REFER ALSO TO CITATION(S) 0208004291, 5393

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 0209004292

4290 **(N—84-27344) Project Noorwidj. Part 4: the radar backscatter of oil spills as measured at platform Noordwijk.** Deloor, G.P. (Physisch Lab. TNO, The Hague (Netherlands). Research Group 1: Physics). Nov 1983. 18p. (PHL—1983-47; TDCK—78759). NTIS, PC A02/MF A01.

Measurements of the radar backscatter of oil spills, made at the offshore platform Noordwijk in the years 1978 and 1979, are reported (X-band). The data set is small therefore comparisons were made with literature data. The data obtained for the contrast fit the more general picture which suggests an angle of maximum contrast. The autocorrelation functions show that the reduction in reflection is due to the reduced influence of the capillaries and short gravity waves in resonance with the radar waves. (ESA)

4291 **(PB—84-220169) Capability of oil industry installations for the disposal of spilt oil.** van Oudenhoven, J.A.C.M.; Durrieu, M.; Foster, F.O.; Roberts, W.G.; Rudd, J.K. (Concawe, The Hague (Netherlands)). 1984. 46p. (CONCAWE—8/84). NTIS, PC E04/MF E01.

This report identifies and explains the constraints faced by oil refineries, terminals or oil storage facilities in disposing of kinds of oily waste and debris collected after a major oil spill. In so doing it should be of particular value as a basis for discussion between authorities and refinery management during the preparation of contingency plans.

0210 Legislation And Regulation

4292 **DOE publishes guide to state and federal laws for ER projects.** *Am. Oil Gas Reporter;* **24**: No. 12, 98-102(Mar 1981).

The US Department of Energy has published a guide of federal and state environmental laws and regulations that affect enhanced recovery projects. The primary emphasis of the publication is on prevention and control of air and water pollution, protection of underground water sources, and management of solid wastes. Only laws and regulations that apply specifically to features unique to EOR, such as emissions for steam generators or underground injections of chemicals, are dealt with. The National Environmental Policy Act of 1979, the Coastal Zone Management Act, the Endangered Species Act, and the Noise Control Act, prinicpal federal laws affecting the siting or operation of EOR facilities, are listed in the handbook, and requirements under these laws are detailed. Tentative requirements under some environmental laws not yet implemented, such as the Underground Injection Control and Resource Conservation and Recovery Act, also are included. The relevant state environmental laws, regulation and permit requirements of 16 major oil-producing states where EOR techniques are important, or could become important, to future oil recovery, are included in the handbook (Alabama, California, Colorado, Illinois, Kansas, Ken-

tucky, Louisiana, Mississippi, Montana, New Mexico, Ohio, Oklahoma, Pennsylvania, Texas, West Virginia, and Wyoming).

0230 Properties

REFER ALSO TO CITATION(S) 0230004286, 5044

4293 **(AD—389945/7) Slurry fuel performance studies. Summary technical report February 1965-February 1966 on phase 1.** Durfee, R.L. (Atlantic Research Corp., Alexandria, VA (USA)). Jun 1966. 249p. NTIS, PC A11/MF A01.

This program was concerned with the development, characterization and combustion testing of advanced boron slurry fuels for use in low-altitude ramjet-powered missiles. Three types of boron were used: commercial grade, submicron, and ultra-fine, high purity boron. Through extensive ball-milling of the submicron and ultrafine powders, slurries could be formulated (in ungelled JP-4 carrier) which were competitive with standard commercial-grade formulations in volumetric heat release, rheology, and stability. Other formulation work resulted in the optimization of a 1965 'workhorse' formulation (basic formulation of 73 per cent ball-milled boron in gelled JP-4) and a slurry of washed boron in isopropanol which can be loaded to a maximum solids content of about 80 per cent. The most critical trade-off among slurry properties is between storage stability and rheology (yield stress and viscosity) at low temperatures. Based on work at the University of Dayton Research Institute, the apparent viscosities of 'standard', shelf-storable slurries of 73 per cent boron in JP-4 and 75 per cent boron in isopropanol at 100/sec shear rate and -65 F are about 5,000 poise and 4,000 poise, respectively. Reduction of these values appears to be one of the most immediate problems in future boron slurry development.

4294 **(AD-A—143390/3) Liquid and solid phase compositions in a partially frozen JP-5 fuel low in n-alkanes. Memorandum report April 1983-January 1984.** Van Winkle, T.L.; Hazlett, R.N.; Beal, E.J.; Mushrush, G.W. (Naval Research Lab., Washington, DC (USA)). 27 Jun 1984. 19p. (NRL-MR—5357). NTIS, PC A02/MF A01.

A JP-5 low in n-alkanes was partially frozen at several temperatures 9 to 15 C below its normal freezing point of -53 C. In spite of their low concentrations in the starting fuel, the n-alkanes were the predominant components in the solid phase crystallizing from the fuel. In this respect, this JP-5 behaves in a fashion similar to other jet fuels which contain 3 to 5 times the amounts of n-alkanes.

4295 **(AD-A—144171/6) Navy mobility fuels evaluation. Final report 20 September 1982-20 May 1984.** Fishman, E.; Mach, M.H.; Fraser, L.M.; Moore, D.P. (TRW Energy Development Group, Redondo Beach, CA (USA)). 20 Jul 1984. 236p. (TRW—39364-6006-UT-00). NTIS, PC A11/MF A01.

There were three tasks in this program: 1) Analytical Chemistry of Sulfur species in JP-5; 2) Materials Compatibility; 3) Lubricity. A chromatographic process coupled with oxidation and reduction of eluate, was successful in providing samples from which a group of aromatic thiophenes were identified by GC/MS. The Materials Compatibility task accomplished quantitative measurements of the degradation of Milspec nitrile rubber, widely used for fuel system seals, in the presence of peroxide formed in JP-5. The vulnerability of nitrile rubber to fuel peroxide was shown to be determined by backbone unsaturation. For the resolution of the lubricity testing problem, it has been demonstrated that the TRW/Lucas Tester provides reproducible values of the friction factor, a property of the fuel itself, which relates directly to boundary lubrication and gear scoring.

4296 **(AD-A—144710/1) Field blending guide for improving the low temperature properties of ground diesel fuels.** Swann, M.B.; Williams, W.R. (Army Belvoir Research and Development Center, Fort Belvoir, VA (USA)). Jun 1984. 51p. NTIS, PC A04/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

A field test to determine the Cloud Point of DF-2 diesel fuels has been developed to aid in the low temperature operation of diesel-powered vehicles and equipment. Some low temperature operability problems can be traced to the normal and/or branched hydrocarbons in the fuels which at low temperature will precipitate and become insoluble. The point when wax crystals first begin to precipitate is called the Cloud Point. Low temperature operability of vehicles and equipment is determined by the Cloud Point of the fuel. The procedures outlined in the report instruct the soldier in the field how to determine the Cloud Point, blending fuels to use, blending ratios, and blending procedures. This report should alleviate some of the low temperature operability problems experienced in the past.

4297 **(PB—84-235688) Diesel fuel quality and effects of fuel additives. Final report.** Moulton, D.S.; Sefer, N.R. (Transportation Research Board, Washington, DC (USA)). May 1984. 72p. NTIS, PC A04/MF A01.

Prepared in cooperation with Southwest Research Inst., San Antonio, TX. Report on National Cooperative Transit Research and Development Program, Synthesis of Transit Practice. Library of Congress catalog card No. 84-50866.

This synthesis will be useful to administrators, engineers, and others in the transit industry concerned with evaluation of diesel fuel and fuel additives used in transit buses. Detailed information is presented on costs, benefits, and adverse effects of available fuel additives and related products. In recent years, environmental awareness, economic pressures, and a general decline in crude oil quality have caused transit operators to seek ways to make use of fuel additives and less expensive blends. This report of the Transportation Research Board includes information on the evaluation of fuel additives and related products in terms of their effects on vehicle maintenance requirements, emissions control, fuel economy, fuel storage, and engine performance.

4298 (ZfI-Mitt—80, pp 111-112) **Variations of the isotopic composition of carbon in organic matter and crude oil from Siberia.** Golyshev, S.I.; Kontorovich, A.Eh. (Sibirskij Nauchno-Issledovatel'skij Inst. Geologii, Geofizikii i Mineral'nogo Syr'ya, Tomsk (USSR)). Nov 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4299 **Gas-phase reactions of Co/sup +/ and Rh/sup +/ with toluene, cycloheptatriene, and norbornadiene.** Jacobson, D.B.; Byrd, G.D.; Freiser, B.S. (Purdue Univ., Lafayette, IN). *Inorganic Chemistry;* **23**: No. 5, 553-557(29 Feb 1984). Contract AC02-80ER10689.

The gas-phase reactions of toluene, cycloheptatriene, and norbornadiene with Co/sup +/ and Rh/sup +/ are described. The dominant process for Rh/sup +/is dehydrogenation, generating a RhC_7H_8/sup +/ complex. These RhC_7H_8/sup +/ ions decompose, yielding RhC/sup +/ (benzene loss), presumably through the intermediacy of a carbide-benzene complex. Rh/sup +/ dehydrogenates toulene-α,α,α-d_3 to eliminate both D_2 (70%) and HD(30%). Cobalt ions react quite differently with no CoC_7H_8/sup +/ or CoC/sup +/ observed. Both Co/sup +/ and Rh/sup +/ abstract hydride from cycloheptatriene, implying D^0(Co-H) > 47kcal/mol. The gas-phase chemistry of Rh/sup +/ is similar to the chemistry observed on metal surfaces for cycloheptatriene and norbornadiene.

0240 Storage

4300 **(AD-A—144649/1) East Coast Regional Petroleum Reserve (RPR). Volume 1. Identification and evaluation of potential storage sites.** Shannon, R.E.; Wyskida, R.M.; Johannes, J.D. (Army Engineer Div., Huntsville, AL (USA)). 29 May 1980. 78p. NTIS, PC A05/MF A01.

See also Volume 1, AD-A144 650.

Volume I presents a detailed description of the procedures and results of a site identification and evaluation process undertaken in support of the regional and noncontiguous petroleum reserve (RPR) proposal. The critical factors and rating guidance used for initial screening are described in appendix b. Potential sites, accept-

ed during the initial screening, were subjected to a final screening where they were point-scored on the basis of an evaluation of specific characteristics. The scoring system, as established by the review and summation team, is described in appendix c. Site scores and ranking under each of the three storage media are shown in appendix d.

4301 **(AD-A—144650/9) East Coast Regional Petroleum Reserve (RPR). Volume 2. Potential storage sites concept design.** Shannon, R.E.; Wyskida, R.M.; Johannes, J.D. (Army Engineer Div., Huntsville, AL (USA)). 30 Sep 1980. 201p. NTIS, PC A10/MF A01.

See also Volume 3, AD-A144 651.

Volume II provides conceptual design drawings, construction cost estimates, and a life cycle cost economic analysis conducted to identify, and quantify, unique economic advantages that may be attributable to the candidate sites.

4302 **(AD-A—144651/7) East Coast Regional Petroleum Reserve (RPR). Volume 3. Potential storage sites related engineering studies.** Shannon, R.E.; Wyskida, R.M.; Johannes, J.D. (Army Engineer Div., Huntsville, AL (USA)). 30 Sep 1980. 346p. NTIS, PC A15/MF A01.

See also Volume 1, AD-A144 649.

Volume III provides three related engineering studies: (1) Development of conductive and convective heat transfer concepts for No. 6 residual oil. (2) Feasibility of heating residual oil storage facilities with solar energy. (3) An analysis of lease vs purchase of storage facilities.

0250 Combustion

4303 **(SVF—149) Emissions from oil-fired domestic furnaces.** Bardh, N.; Ahling, B. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Jan 1984. 73p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750209.

The emissions from three types of small furnaces with an output between 20 and 1000 kW have been investigated. The object of the program was to compare three types of furnaces and to investigate the emissions with varying excess air, loading and number of on/off cycles per hour. The emissions from optimally adjusted and normally operating burners were as follows per MJ fuel. The emission range depends on the type of burner that has been examined. CO: <5-15 mg/MJ, Total gas phase hydrocarbons (THC) as equiv. CH_4: <1,4-8 mg/MJ, NO(sub)x: 15-45 mg/MJ, extractable matter (zGC) 80-300 μg/MJ, Σ polyaromatics (PAH): 4-50 μg/MJ. Intermittent operation caused an 50 percent increase of CO-emission from the older types of burners. The emissions of heavier organics generally increased with increasing numbers of on/off cycles per hour. The emission range from a non optimally adjusted burner was as follows: 300-1000 mg/MJ, THC: 9-50 mg/MJ, NO(sub)x: 15-45 mg/MJ, Particulates: 15-20 mg/MJ, ΣGC: 200-500 μg/MJ, ΣPAH: 8-125 μg/MJ. In these cases intermittent compared with constant operation also brought about a 50-100 percent increase of the emission with respect to THC.

03 NATURAL GAS

0301 Reserves

REFER ALSO TO CITATION(S) 0301004273, 4274, 4308

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 0302004274, 4275, 4276, 4277, 4278

4304 **Model for fracture genesis: application to Mesaverde group, Piceance Creek basin, Colorado.** Teufel, L.W.; Warpinski, N.R.; Lorenz, J.C. (Sandia National Laboratories, Albuquerque, NM). *American Association of Petroleum Geologists, Bulletin;* **68**: No. 4, 534(Apr 1984). (CONF-8405216—).

From AAPG annual convention; San Antonio, TX, USA (20 May 1984).

Natural fractures play an important role in determining gas production from the low-permeability reservoirs of the Mesaverde Group in the Piceance Creek basin, Colorado. The importance of natural fractures is evident from the number of natural fractures observed in core and from the high in-situ permeabilities measured in well tests as compared to the low permeabilities measured in core. An understanding of the natural fracture systems requires knowledge of variations in the state of stress and changes in the physical and mechanical properties of the different sedimentary layers during the evolution of the basin. Geologic processes such as burial, diagenesis, tectonics, uplift, and erosion, and their resultant effects on the overburden, pore pressure, temperature, and strain were included in an elastic-plastic model to approximate the stress history of the basin. These data, coupled with an extended von Mises failure criterion derived from laboratory experiments of the rocks in question, were used to predict the relative time and type of fracturing, and the lithologic layers in which a fracture was likely to occur. Observations of fractures in 4200 ft (1280 m) of core (1200 ft, 365 m, of oriented core) from the Mesaverde Group taken from the US Department of Energy's 3 closely spaced wells near Rifle, Colorado, have been used to document the genesis of natural fractures and substantiate the model results. Empirical information such as the present state of in-situ stress determined from hydraulic fracture stress tests and anelastic strain recovery measurements of oriented core, paleostrain directions and magnitudes determined from analysis of calcite twin lamallae, and current temperature and pore pressure provided data as well as checks on the accuracy of the model.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 0303004273, 4282

4305 **(PB—84-237809) Eastern gas shale database development program. Annual report 1 May 1983-30 April 1984.** DeVos, D.R.; Hasselback, F.W.; Hoffmann, R.L.; Lerner, B.J.; May, J.E. (BDM Corp., McLean, VA (USA)). Jul 1984. 54p. NTIS, PC A04/MF A01.

The Gas Research Institute (GRI) Eastern Gas Data System is an interactive information resource developed to provide ready access to substantive data on wells producing from the Devonian shales. The system is a computerized database which contains descriptive and historical geological and engineering data on a large number of Devonian shale gas wells in the Appalachian Basin. The principal purpose of the system is to meet the requirements for technical data of gas producers, researchers and GRI. The data is provided by cooperating industry sources, many of whom were also instrumental in the original definition and design of the system. The information which has been collected and compiled on individual wells includes data on identification, location, elevation, drilling, geology, cementing, perforation, stimulation, cleanup, and production histories. The Eastern Gas Data System currently contains extensive information on over 620 Devonian shale gas wells completed in the Appalachian Basin.

0305 Health And Safety

4306 **(N—84-25161) Liquefied energy gas terminal risk: a comparison and evaluation.** Mandl, C.; Lathrop, J. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). Dec 1983. 62p. International Inst. for Applied Systems Analysis, Laxenburg, Austria.

Various risk assessment procedures as they apply to liquefied energy gas (LEG) terminal siting are discussed. The risks estimated job for LEG sites are quantified and compared.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 0306004289, 4312

4307 **(DOE/EIA—0145(83)) Statistics of interstate natural gas pipeline companies 1983.** Mack, J. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Nov 1984. 398p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE85003509.

The 1983 financial and operating information presented in this report indicates that the 102 Class A and B interstate natural gas pipeline companies reported assets totaling $70.1 billion, as of December 31, 1983, compared with $64.9 billion on December 31, 1982. Gross gas utility plant investments at the end of the year amounted to $46.5 billion; and net gas utility plant assets amounted to $24.9 billion. The Class A and B pipeline companies reported total gas operating revenues of $64.3 billion. Sales of natural gas decreased from 16.2 trillion cubic feet in 1982 to 14.3 trillion cubic feet in 1983. Sales of natural gas to ultimate consumers decreased from 2.8 trillion cubic feet in 1982 to 2.4 trillion cubic feet in 1983. Sales to other gas utilities decreased from 13.3 trillion cubic feet in 1982 to 11.9 trillion cubic feet in 1983. Revenues from these sales to ultimate consumers amounted to $11.9 billion in 1982 and $11.7 billion in 1983. Revenues from sales for resale to other gas utilities amounted to $49.2 billion in 1983 and $49.4 billion in 1982. The total number of natural gas customers was 6,708,271 in 1983, compared with 6,669,932 in 1982. Of these, ultimate consumers totaled 6,705,154, and there were 3117 wholesale gas utility customers. The collection of financial and operating statistics on the natural gas industry reported here is limited under the Natural Gas Act to that segment of the industry subject to the FERC's regulatory jurisdiction. Thus, the collected statistics represent less than full industry coverage. Major interstate natural gas pipeline companies with extensive transmission systems accounted for 88.3% of the total purchased gas, 88.7% of the total assets, 88.3% of the gas operating revenues, and 97.2% of the sales for resale. 28 tables.

4308 **(DOE/EIA—0167(83)) Gas supplies of interstate natural gas pipeline companies, 1983.** Pridgen, V. (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Nov 1984. 118p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. File Number DE85002874.

This report provides information on the total reserves, production, and deliverability capabilities of the 86 interstate pipeline companies required to file the Federal Energy Regulatory Commission (FERC) Form 15, Interstate Pipeline's Annual Report of Gas Supply. Total dedicated domestic gas reserves, owned by or under contract to the interstate pipeline companies, decreased in 1983 by 4.2 trillion cubic feet (Tcf), or 4.3%, from 98.7 Tcf at the beginning of the year to 94.5 Tcf at the end of the year. A 5-year tabulation shows that dedicated domestic gas reserves increased slightly from 94.0 Tcf at the beginning of 1979 to 94.5 Tcf at the end of 1983, an increase of 0.5 Tcf, or 0.5%. Total gas purchased and produced from the dedicated domestic gas reserves in 1983 was 9.5 Tcf, down 13.1% from the 10.9 Tcf reported in the preceding year. The 1983 ratio of total dedicated domestic reserves to production was 10.0, significantly above the 9.0 ratio reported for 1982. Net revisions to dedicated domestic gas reserves during 1983 are calculated at -0.5 Tcf, as compared to 1.4 Tcf in 1982. Total interstate reserve additions during 1983 are reported to be 5.8 Tcf, compared to additions of 9.9 Tcf in 1982. Total natural gas imported by interstate pipeline companies from two foreign sources, Canada and Mexico, was 0.8 Tcf, 7.4% of the total gas produced and purchased in 1983. Imports of LNG from Algeria totaled only 0.09 Tcf. Total deliveries are projected to decline from 12.9 Tcf in 1984 to 7.1 Tcf by 1988. This decline is driven by the projected decline in domestic reserve deliverability. Deliveries from foreign and other sources are expected to remain relatively constant over the 5-year period. 8 figures, 18 tables.

4309 **Study of alternatives to the Natural Gas Policy Act of 1978.** Abbott, C. (Dept. of Energy, Washington, DC). *Interstate Oil Compact Commission Committee Bulletin;* 23: No. 2, 1-3(Dec 1981).

The findings of the Department of Energy's assessment of current and alternative natural gas policies were presented. Energy Secretary James B. Edwards initiated the review in March of 1981 to determine the possible effects of changes in pricing regulations on the price and production of natural gas. An evaluation of the Natural Gas Policy Act was given. Possible future alternative policies discussed included extension of price controls, full decontrol in 1982, phased decontrol, and implications of extended controls.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 0308005111

4310 **(UCRL—91741) Dispersion phenomenology of LNG vapor in the Burro and Coyote LNG spill experiments.** Morgan, D.L. Jr. (Lawrence Livermore National Lab., CA (USA)). Oct 1984. Contract W-7405-ENG-48. 21p. (CONF-841201—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003591.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

Various physical phenomena affecting LNG vapor dispersion were observed in LNG spill experiments conducted by the Lawrence Livermore National Laboratory. Understanding the phenomena is necessary in predicting the size of the hazardous region of vapor concentration following a spill. Gravity flow of the cold dense vapor increased cloud width while density stratification and heat flow from the ground had substantial effects on the mixing rate with air. These phenomena led to a dependence of the maximum distance (£) to the lower flammability limit on source rate, wind speed, and atmospheric stability that was substantially different from the prediction of the Gaussian plume model. Studies employing the numerical SLAB model demonstrate the importance of including these phenomena in predictive models. Time-dependent features of the concentration field due to turbulence and rapid phase-transition explosions, which also affect £, were examined by applying a space-time interpolation scheme to the concentration data. 20 references, 5 figures, 2 tables.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 0309004233, 4272

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 0310004309

4311 **(PB—84-200351) Mitsubishi Juko Giho, volume 21, number 2, 1984.** (Mitsubishi Heavy Industries Ltd., Tokyo (Japan)). 1984. 239p. (In Japanese). NTIS, PC E11/MF E01.

Summary in English.

This issue contains a number of technical reports prepared by scientists and technicians of MHI. Some of the subjects covered are: Fundamental Studies on Physical Properties at Low Temperatures; Hydrodynamic Design and Development of Large LNG Carriers and LPG Carriers built in MHI; Structural Design of Spherical Tank Type LNGC (Hull and Tank System); Study on Materials and Reliabilities of Spherical Tank Type LNG Carriers; Construction of Spherical Tank Type LNG Carriers; Development of an Automatic Welding Technique for Thick Aluminum Alloys; Dynamic Loads on Ship Hull and Internal Structure of Membrane Type LNGC; Structural Design of Rectangular Independent Tank of LPG Carrier; Research and Development on Offshore LNG Plant; A Computer Program for Seismic Response Analysis of Storage Tanks Coupled with Liquid Contents and Soil Under Foundation; Experimental Study on LNG Rollover Using Liquid Freon; Practical Application of a LNG Cold Energy Recovery Power Plant.

4312 **DOE study: decontrol natural gas by 1982.** *Am. Oil Gas Reporter;* 24: No. 12, 67-68, 147(Mar 1981).

A US Department of Energy Policy Report admits of mistakes in present natural gas regulations, and foresees the country's foreign energy dependence to be virtually unchanged by the end of

the decade. Further, the report says legislation should be developed to exempt newly discovered oil and incremental tertiary production from the crude oil Windfall Profit Tax. The possibility of establishing a strategic natural gas reserve also is suggested. In addition, it recommends decontrol of natural gas prices by the end of 1982, suggesting it would be counterproductive to await the 1985 date set under current law. The report says the present decontrol strategy, enacted in 1978, creates considerable uncertainty about the future natural gas market, and continues to keep the resource underpriced and inefficiently used. Decontrol in 1982 could reduce oil imports an estimated 300,000 to 600,000 bpd by 1985, depending on the method of decontrol used. However, the report points out, new policies that would be beneficial to the domestic gas supply also would have a slowing effect on the nation's economy. Accelerated decontrol, and the transfer of wealth from consumers to gas producers, would increase inflation in the short run and slow real growth of the gross national product.

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 0320004308

4313 **(STUDSVIK-EI—83-155) Attempt to cost comparison with conventionally constructed and prefabricated pipelines for gases, the prefabricted ones being placed on the surface adjacent to public roads.** Andersson, S. (Studsvik Energiteknik AB, Nykoeping (Sweden)). Sep 1983. 40p. (In Swedish). (STU—82-4174). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750225.

Prefabricated pipelines for gas seem to be preferred to ordinary welded tubes where the tangential stress may amount to 3500 x 10^5N per m and may cause cracks. Prefabricated pipelines have load-bearing welds only at line valves. This investigation shows that a prefabricated pipeline on the surface at a road side will be 8 x 10^9 m^3 per year, the pressure being 300 x 10^5N per m^2. The diameter of the tube was 1 m and its length 2000 x 10^3 m. when a prefabricated pipeline is to be placed on the bottom of the sea then ballast will be unnecessary and the tube will remain flexible.

0330 Properties

REFER ALSO TO CITATION(S) 0330005021

4314 (ZfI-Mitt—80, pp 136) **Preparation of CO_2 for $^{13}C/^{12}C$ analysis of hydrocarbons in natural gases.** Wolacewicz, W.; Halas, S. (Uniwersytet Marii Curie-Sklodowskiej, Lublin (Poland). Inst. Fizyki). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

0350 Storage

REFER ALSO TO CITATION(S) 0350004311

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

4315 **Programmed pyrolysis of organic matter from thermally altered Cretaceous black shales.** Peters, K.E.; Hunt, J.M.; Tarafa, M.E.; Whelan, J.K. (Chevron Oil Field Research, La Habra, CA). *American Association of Petroleum Geologists, Bulletin;* **67**: No. 11, 2137(Nov 1983).

Organic-rich Cretaceous black shales from the Cape Verde Rise in the eastern Atlantic were penetrated by hot diabase sills during the Miocene. Programmed pyrolysis and pyrolysis-gas chromatography of organic matter from core samples taken at various distances from a major sill were used to show: the type of kerogen, its relative level of thermal maturity, the fraction of pyrolyzable organic compounds which are free, and the compositions of the bitumen and kerogen. The dominant factor affecting these sediments appears to be thermal maturity rather than differences in the quality of the organic matter. Systematic changes in the pyrolyzate resulted from thermal cracking of volatile organics from the oil-prone Type II kerogen. Generation of these products caused progressive aromatization of the residual kerogen closer to the sill. These conclusions are supported by changes in kerogen elemental compositions, quantity of bitumen extract, and vitrinite reflectance. Although the major sill is 15 m (about 50 ft) thick, solvent extraction and pyrolysis results show that hydrocarbon generation was restricted to within about 10 m (about 33 ft) of the shale/sill contacts. At equal distances, the maximum temperature reached by the shales was higher above than below the sill. The reflectance of vitrinite responds more rapidly than bitumen composition to high temperatures imposed over a short time.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 0404006204

4316 **(AD-A—144468/6) Evaluation of a novel catalyst system for producing jet fuel from whole crude shale oil. Final report 15 August 1982-31 December 1983.** Tait, A.M.; Hensley, A.L. (Amoco Oil Co., Naperville, IL (USA)). Feb 1984. 113p. NTIS, PC A06/MF A01.

The purpose of this experimental study was to evaluate a novel catalyst system for the production of JP-4 jet fuels from a whole shale oil on a once-through basis. The dual-catalyst system consists of a pretreat catalyst specifically designed to remove nitrogen, as ammonia, from organo-nitrogen compounds, and the previously developed hydrocracking catalyst. Since hydrocracking activity is critically dependent upon almost total removal of contaminant nitrogen compounds, it was proposed that the use of the dual-catalyst system would significantly improve the process with respect to catalyst lifetimes and feed throughput.

4317 (DOE/METC—84-10, pp 159-168) **Modeling the HYTORT process for eastern oil shale using the CRAY-1 ASPEN flowsheet simulator.** Phillips, T.T.; Parkinson, W.J. (Los Alamos National Lab., NM). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The Los Alamos National Laboratory CRAY-1 version of the ASPEN code was used to simulate the HYTORT process for retorting eastern oil shale. The model includes 40 unit-operation blocks, 5 FORTRAN blocks, and 4 design specifications. The retort was modeled using four separate reactor blocks so that the thermal effects of the different reactions in the retort could be analyzed. FORTRAN blocks were used extensively in the retort module to adapt the ASPEN reactor blocks to our model for the retorting reaction chemistry. The HYTORT plant model includes a cold box for recovering H_2 from the retort off-gas for recycle, and a steam-methane reformer unit for producing H_2 for the hydrotreater and for retort make-up. The HYTORT plant model was used to perform a process-sensitivity study to relate oil and fuel gas production and oxygen consumption to retort temperature. The HYTORT complex products had the greatest fuel value at a retort temperature of 1500°F, which was the higher temperature considered. 9 references, 6 figures, 3 tables.

4318 **Trace sulfur-containing species in the offgas from two oil shale retorting processes.** Sklarew, D.S.; Hayes, D.J.; Petersen, M.R.; Olsen, K.B.; Pearson, C.D. (Pacific Northwest Laboratories, Richland, WA). *Environmental Science and Technology;* **18**: No. 8, 592-600(Aug 1984). Contract AC06-76RL01830.

Six non-H_2S sulfur species were identified and quantitated from two different retorting processes, a modified in situ process and an aboveground process. Carbonyl sulfide (COS), methyl mercaptan (CH_3SH), carbon disulfide (CS_2), thiophene, methylthiophene, and sulfur dioxide (SO_2) were determined by gas chromatography combined with a flame photometric detector. One of the in situ retorts produced the highest concentrations of sulfur species

while the aboveground retort produced the least of the three retorts studied. However, other modified in situ retorts have been reported to produce relatively low concentrations of sulfur species. Variability in the quantitative data was attributed to variability both in sulfur content of the raw oil shales and in retort conditions. Possible reaction mechanisms were considered. The non-H_2S sulfur species comprise 0.4-6% of the low molecular weight sulfur species measured in the retort off-gases. Abatement strategies must consider the presence of these trace species if the air quality standards proposed by Colorado are to be maintained.

4319 Trace nitrogen-containing species in the offgas from two oil shale retorting processes. Sklarew, D.S.; Hayes, D.J. (Pacific Northwest Laboratories, Richland, WA). *Environmental Science and Technology;* **18**: No. 8, 600-603(Aug 1984).

Five organic nitrogen species were identified in the offgas from two different retorting processes, a modified in situ process and an aboveground process. Hydrogen cyanide, acetonitrile, acrylonitrile, propionitrile, and isobutyrontrile were determined by gas chromatography combined with a nitrogen-phosphorus detector. Seven other nitrogen species have been tentatively identified in the offgas at one of the in situ retorts. The low molecular weight organic nitrogen species appear to be predominantly nitriles; low molecular weight aliphatic amines do not appear to be present. Possible reaction mechanisms were considered. The nitriles were present in amounts on the order of tens of ppm which was ~ 1-2% of the gas-phase ammonia nitrogen concentration in the offgas. Most of the nitrogen species except hydrogen cyanide appear to be reasonably stable, at least qualitatively, for a period of several months in Teflon-lined stainless steel bombs.

4320 Development and testing of spent shale grouts for backfilling abandoned in-situ oil shale retorts. Persoff, P. (Lawrence Berkeley Laboratory, Univ. of California). *Journal of Petroleum Technology;* **36**: No. 7, 1033-1035(Jun 1984).

Grouts based on Lurgi spent shale were developed for backfilling in-situ oil shale retorts. Lignosulfonate fluidizer (0.25%) was used to achieve adequate fluidity. Addition of 10% fly ash increased the strength of the grouts. Permeabilities of the grouts decreased at higher confining pressures and were low enough to reduce leaching by groundwater.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 0405004286

4321 (NP—5900128) Characterization of Devonian oil shales by hydrogen pulse NMR. Project report for 1983-84. Harrell, J.W. Jr. (Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1984. 36p. SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486. File Number TI85900128.

NMR and ESR measurements have been used to characterize eastern and western United States oil shales. T_1 measurements which were made at 90 MHz as a function of temperature, together with previously reported 36 MHz results, suggest that paramagnetic centers contribute strongly to the relaxation in some of the shales. A careful study of the ESR spectrum at both X-band and K-band frequencies suggests that a part of the spectrum may be due to naturally irradiated silicates in the shales. Laboratory irradiation experiments suggest a method for determining the age of the oil shale deposits. A new technique has been developed for measuring second moments of the NMR power spectrum. Measurements made on a Colorado shale show a rapid decrease with increasing temperature in the vicinity of a previously reported T/sub 1r/ minimum. Unpaired electron spin concentrations and room temperature T_1 values were measured in 60 oil shale samples from north Alabama and south Tennessee. No correlation between spin concentration and oil Fischer assay was observed except for samples from a 100 ft bore hole in Etowah Co., AL, where a linear correlation was observed. Room temperature T_1's were found to approximately increase with increasing spin concentration, supporting the contention that relaxation due to interactions with paramagnetic centers is important. 11 references, 14 figures.

0406 Direct Uses And By-products

4322 (AD-A—144504/8) Decision Recommendation Board (DRB) report. Transition of shale JP-4 to the operational validation phase. Final report August 1983-May 1984. Botteri, B.P.; Churchill, A.V.; Bleidorn, C.G. (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH (USA). Aero-Propulsion Lab.). 15 May 1984. 23p. (AFWAL-TR—84-2050). NTIS, PC A02/MF A01.

HQ USAF Program Management Directive (18 Sep 1980,) for PE71112F established an Air Force commitment to begin the operational validation of JP-4 fuel made from shale oil in 1984. The Air Force Systems Command was designated as participating command and given specific responsibilities for providing product quality, performance, system safety and environmental and health assurances prior to the start of any operational validation testing. The Shale JP-4 Decision Recommendation Board (DRB) was established in August 1983 to provide an independent assessment of the acceptability of transitioning shale JP-4 fuel to the operational validation phase. This report addresses the acceptability of transitioning shale JP-4 to Mountain Home AFB, Idaho, and Hill AFB, Utah, the two bases selected by the Air Staff for the Validation Program. Extensive shale JP-4 fuel properties characterization and aircraft system testing have been conducted by AFSC primarily under the Aero Propulsion Lab's PE63215F.

4323 (AD-A—145159/0) Joint DOD/DOE Shale Oil Project. Volume 3. Testing of refined shale oil fuels. Final report for period ending November 1983. Hazard, H.R.; Rising, B.; Barnhart, J.; Steedman, W.G. (Battelle Columbus Labs., OH (USA)). Dec 1983. 325p. NTIS, PC A14/MF A01.

This report is the third of 3 volumes describing the Joint DOD/DOE Shale Oil Project. It summarizes results of tests to evaluate suitability of shale JP-5, shale DFM, and shale residual oil for use in a wide variety of engines, including marine boilers, diesel engines and gas turbines; various commercial engines; and aircraft gas turbine engines. The shale fuels proved completely acceptable for use in every engine in which it was evaluated. In addition, toxicity and mutagenicity were found to be similar to those for petroleum fuels.

0407 Health And Safety

REFER ALSO TO CITATION(S) 0407005561

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 0409004320

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 0410004320, 4323, 5533

4324 (DOE/RA/32012—T18) Long-range resource utilization of NOSR 1: site and soil investigations. Naval Oil Shale Reserves management support and systems engineering project. (TRW Energy Systems Planning Div., McLean, VA (USA)). Sep 1980. Contract AC01-78RA32012. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE84006902.

During the summer of 1980, a site and soil investigation program was completed on NOSR 1. This program involved the drilling/coring of 10 shallow core holes (less than 200 feet), 26 auger holes, 4 trench excavations, and associated access road development and reclamation. A laboratory program completed numerous classification tests on soil samples and extensive logging of rock cores. The site and soil investigation program was designed to determine the suitability of the NOSR 1 site for construction of commercial-size oil shale plants. Four representative ridge-top plant sites were examined, along with three mine portal sites, and three dam sites. Limited work was performed in the primary disposal site

for spent shale in upper Trapper Creek. Program results indicate that any of the proposed plant sites, and presumably any ridge-top location with sufficient room for development, would be satisfactory from a foundation viewpoint. Dam site locations were evaluated to determine the effect of water retention on leakage into the mining horizons below. Each of the mine sites investigated was found to be potentially suitable for mine entry and development, although Sites 1 and 3 were not drilled directly. The conclusions for Sites 1 and 3 are based on visual examination, and will need verification through drilling, coring, and testing. Both sites will require more road access development before drilling can be completed there. No obvious problems were found with disposal of spent shale in Trapper Creek, other than a potentially leaky base. A leaky foundation for a spent shale disposal area could potentially complicate the design by requiring the installation of an impermeable seal to prevent percolation of water through the spent shale and into the groundwater.

05 NUCLEAR FUELS

4325 **Ion exchange and adsorption in nuclear chemical engineering.** Schultz, W.W.; Burney, G.A.; Godbee, H.; Mallory, C.W.; Wallace, R.M.; Wheelwright, E.J. (Rockwell Hanford Operations, Richland, WA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **80**: No. 233, 96-109(1984).

The nuclear industry involves a number of operations. Uranium ore must first be mined and the uranium recovered from the ore, purified, and concentrated. After the uranium has been enriched and fabricated into fuel elements, it is placed in nuclear reactors where it produces energy, fission products, and transmutation products. Finally, if the fuel cycle is completed, the uranium and useful transmutation products are recovered and separated from each other as well as from the fission products. The uranium may be recycled or used elsewhere, while most of the fission products become waste. Ion exchange finds use in nearly every part of the nuclear fuel cycle; these uses are the subject of this paper.

0503 Mining

REFER ALSO TO CITATION(S) 0503004394, 4395, 5224

4326 **(PB—84-224492) Microcomputer-based monitoring and control system with uranium mining application. Information circular.** Sheeran, C.T.; Franklin, J.C. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). 1984. 35p. (BM-IC—8981). NTIS, PC A03/MF A01.

Library of Congress catalog card No. 84-600091.

The Bureau of Mines investigated a microprocessor-based real-time control and monitoring system for uranium mining applications. The system is capable of controlling and monitoring up to 768 stations within 3 km of the central processor on a common four-wire cable. It can be used in conjunction with detectors to continuously monitor and display radiation working levels at points throughout the mine. Surface alarms are sounded for critical situations such as rapid radiation buildup, loss of power to monitors or fans, and changes in air door position. Permanent records of all changes are automatically printed out with their time of occurrence. Printouts can also be obtained for shift reports or trend logs. The system can be used to remotely control fan startup and shutdown, and also can alert miners of underground conditions by blowing horns or turning on lights. Battery backup keeps the system operative for up to 4 h in case of a mine power outage. A special software feature permits automatic, time-delayed, sequential restart of fans.

0504 Feed Processing

4327 **(MRP/MSL—80-166(IR)) Preconcentration of a low-grade uranium ore yielding tailings of greatly reduced environmental concerns. Part V. CPDU investigation of Agnew Lake ore: 0.057 percent U.** Raicevic, D.; Raicevic, M. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Nov 1980. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780093.

The low-grade ore sample used for this investigation contained 0.057 percent uranium with uranothorite as the major uranium-bearing mineral and a small amount of brannerite, occurring in the quartz-sericite matrix of a conglomerate. The preconcentration procedures, consisting of pyrite flotation with or without flotation of radioactive minerals, followed by high intensity wet magnetic treatment of the sized flotation tailings, produced pyrite and radioactive concentrates of acceptable uranium grades ranging from 0.1 to 0.135 percent uranium. The combined concentrates comprised 37 to 49 percent of the ore by weight with the following combined recoveries: 95.6 to 97.9 percent of the uranium; 94.7 to 96.3 percent of the radium; 97.8 to 99.3 percent of the thorium over 98 percent of the pyrite. The preconcentration tailings produced comprised between 51 and 63 percent of the ore by weight and contained from: 0.0022 to 0.0037 percent U; 12 to 17 pCi/g Ra; 0.002 to 0.004 percent Th less than 0.03 percent S. Because these tailings are practically pyrite-free, they should not generate acidic conditions. Due to their low radium content, their radionuclide hazards are greatly reduced. These preconcentration tailings therefore, could be suitable for surface disposal, mine backfill, revegetation or other uses.

4328 **(OSQ—80-00030) Chlorine/chloride based processes for uranium ores. Final report.** (Lummus Canada Inc., Willowdale, Ontario (Canada); Canada Centre for Mineral and Energy Technology, Ottawa, Ontario). Nov 1980. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780095.

Work performed for the Canada Centre for Mineral and Energy Technology.

The CE Lummus Minerals Division was commissioned by The Department of Supply and Services to develop order-of-magnitude capital and operating cost estimates for chlorine/chloride-based processes for uranium ores. The processes are designed to remove substantially all radioactive constituents from the ores to render the waste products harmless. Two processes were selected, one for a typical low grade ore (2 lb. U_3O_8/ton ore) and one for a high grade ore (50 lbs U_3O_8 /ton). For the low grade ore a hydrochloric acid leaching process was chosen. For high grade ore, a more complex process, including gaseous chlorination, was selected. Capital cost estimates were compiled from information obtained from vendors for the specified equipment. Building cost estimates and the piping, electrical and instrumentation costs were developed from the plant layout. Utility diagrams and mass balances were used for estimating utilities and consumables. Detailed descriptions of the bases for capital and operating cost estimates are given.

0505 Enrichment

4329 **(JAERI-M—83-123) Economic evaluation of laser enrichment plant.** Arisawa, Takashi; Shiba, Koreyuki. (Japan Atomic Energy Research Inst., Tokyo). Aug 1983. 78p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE84703303.

Operational characteristics of Laser Enrichment Plant are described based on the data available at present. And its economy is also discussed from the view point of investment and energy consumption. In the procedure of this estimation, the composition of the plant is firstly considered, secondly each component is designed, and thirdly the production cost of each component is estimated. Then the sensitivity of the component cost on the plant cost is analysed, which leads to the optimization of the product cost and the determination of the economic plant size, etc. The results shows that the power cost of the electric gun occupies the large majority of the total power cost, and that the capital cost of laser devices occupies most of the total capital cost.

4330 **(K/TS—5360) Pilot program for an automated data collection system.** Burns, R.S.; Johnson, P.S.; Denny, E.C. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1984. Contract AC05-84OT21400. 5p. (CONF-8409133—1). NTIS, PC A02. File Number DE84016809.

From American Society for Engineering Management meeting; Dallas, TX, USA (23 Sep 1984).

This report describes the pilot program of an automated data collection system and presents some of the managerial experiences

during its startup. The pilot program demonstrated that improvements can be made in data collection and handling, even when a key hardware item does not meet requirements. 2 figures, 1 table.

4331 **(SAND—84-0985C) Comparison of shock-induced displacements with displacements produced by a centrifuge acceleration.** Priddy, T.G.; Rodeman, R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. (CONF-850118—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000467.

From 3. international modal analysis conference; Orlando, FL, USA (28 Jan 1985).

Verification of the functional reliability of some electrical components under the action of mechanical shock is often desired. As an example, contact chatter (the closure for short-time intervals) of the normally open contact points in a thermal switch is a possible failure model which must be screened out by testing. Theoretically, it should be possible to do this acceptance testing with a centrifuge at a lower cost if one could determine the centrifuge acceleration level needed to produce the maximum displacement that could be realized under a given shock loading. A method was derived to determine this displacement relationship for the two different types of loads. A superposition-of-modes technique was used to develop the relationship. Numerical results are presented for a simple cantilever where closed-form solutions for modal parameters are readily available. The peak response in each mode is determined and all such peaks are summed to determine the maximum that could be realized from a based-excited, haversine acceleration pulse. This numerical result is then compared with the centrifuge-induced displacement to determine the desired relationship. This result was then successfully used to infer the cntrifuge level needed to test a small, mechanically complicated, thermal switch. 3 references, 3 figures.

4332 **(UCID—20189) AVLIS Production Plant Project Management Plan.** (Lawrence Livermore National Lab., CA (USA); Martin Marietta Energy Systems, Oak Ridge, TN (USA)). 15 Nov 1984. Contract W-7405-ENG-48;AC05-84OR21400. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85002962.

The AVLIS Production Plant is designated as a Major System Acquisition (in accordance with DOE Order 4240.IC) to deploy Atomic Vapor Laser Isotope Separation (AVLIS) technology at the Oak Ridge, Tennessee site, in support of the US Uranium Enrichment Program. The AVLIS Production Plant Project will deploy AVLIS technology by performing the design, construction, and startup of a production plant that will meet capacity production requirements of the Uranium Enrichment Program. The AVLIS Production Plant Project Management Plan has been developed to outline plans, baselines, and control systems to be employed in managing the AVLIS Production Plant Project and to define the roles and responsibilities of project participants. Participants will develop and maintain detailed procedures for implementing the management and control systems in agreement with this plan. This baseline document defines the system that measures work performed and costs incurred. This plan was developed by the AVLIS Production Plant Project staff of Martin Marietta Energy Systems, Inc. and Lawrence Livermore National Laboratory in accordance with applicable DOE directives, orders and notices. 38 figures, 19 tables.

4333 **(UCID—20196) AVLIS Production Plant Preliminary Quality Assurance Plan and Assessment.** (Lawrence Livermore National Lab., CA (USA); Martin Marietta Energy Systems, Oak Ridge, TN (USA)). 15 Nov 1984. Contract W-7405-ENG-48;AC05-84OR21400. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002958.

This preliminary Quality Assurance Plan and Assessment establishes the Quality Assurance requirements for the AVLIS Production Plant Project. The Quality Assurance Plan defines the management approach, organization, interfaces, and controls that will be used in order to provide adequate confidence that the AVLIS Production Plant design, procurement, construction, fabrication, installation, start-up, and operation are accomplished within established goals and objectives. The Quality Assurance Program defined in this document includes a system for assessing those elements of the project whose failure would have a significant impact on safety, environment, schedule, cost, or overall plant objectives. As elements of the project are assessed, classifications are provided to establish and assure that special actions are defined which will eliminate or reduce the probability of occurrence or control the consequences of failure. 8 figures, 18 tables.

4334 **Laser R & D at the Lawrence Livermore National Laboratory for fusion and isotope separation applications.** Emmett, J.L.; Davis, J.I.; Krupke, W.F. (Laser Program, Lawrence Livermore National Laboratory, University of California, Livermore, CA 94550). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-20**: No. 6, 591-602(Jun 1984).

Application objectives of the Laser Fusion and Isotope Separation Programs at Lawrence Livermore National Laboratory are reviewed, and projected laser system performance requirements for each application are summarized. Historical perspectives of the laser technology options considered to meet these requirements are described, and technical highlights in the ensuing development of Nd: glass (fusion), and copper vapor and tunable dye (isotope separation) laser systems are given.

4335 **Lasers in chemistry: nearing the breakthrough?.** Davis, J.I.; Chen, H.L. (Lawrence Livermore National Lab., CA). *Photonics Spectra;* 1-7(Oct 1982).

The application of lasers to industrial chemistry has been an attractive field of research for some time, but the results in most areas have not met the early and ethusiastic expectations. Three applications of lasers are examined: (1) uranium isotope separation, (2) radioactive waste cleanup, and (3) trace impurity removal. Also presented is a brief discussion of two other promising technologies, chemical synthesis by laser-initiated chain reaction and laser synthesis of pharmaceuticals.

4336 **(WH-Trans—509) Centrifuge process for uranium enrichment.** Translated from *Atomkernenergie/Kerntechnik ;* **35**: No. 3, 161-165(1980). 12p. NTIS MF A01. File Number DE85900010. DE85900010

The centrifuge process is described in detail, including the principles of separation physics, the centrifuge separative element, industrial application, and construction of separation plants.

0506 By-products

4337 **(AD-A—142076/9) Evaluation and demonstration of the viability of salt bath solution heat treatment for depleted uranium penetrators. Final report February 1983-January 1984.** Muller, J.F.; Nead, R.L. (Aerojet Ordnance Co., Jonesboro, TN (USA). Heavy Metals Div.). Mar 1984. 39p. NTIS, PC A03/MF A01.

A MM and T program to evaluate and demonstrate the viability of a salt bath solutionizing heat treatment for large caliber DU penetrators (0.75% by weight titanium) was conducted. One hundred M774 core blanks were evaluated to develop and verify the various process stages (e.g., outgassing salt residence times, etc.) of salt heat treatment. A viable salt bath heat treatment process was developed through this program. A pilot lot of 40 finished machined M774 penetrators was fabricated under the guidelines of this program and is available for ballistic testing. Included in this report is a general analysis of facility requirements to implement salt solutionizing heat treatment into the Aerojet production stream.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 0507004665, 4954, 4955

4338 **(HEDL-SA—2853-FP) Sintered-to-size FBR fuel.** Rasmussen, D.E.; Schaus, P.S. (Hanford Engineering Development Lab., Richland, WA (USA)). Apr 1984. Contract AC06-76FF02170. 28p. (CONF-840440—8). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85003000.

From 86. annual meeting and exposition of the American Ceramic Society; Pittsburgh, PA, USA (29 Apr 1984).

Fabrication of sintered-to-size PuO_2-UO_2 fuel pellets was completed for testing of proposed FBR product specifications. Approximately 6000 pellets were fabricated to two nominal diameters and two densities by cold pressing and sintering to size. Process control and correlation between test and production batches are discussed.

4339 (PNCT—831-81-01, pp 43-50) **Development of an inspection method of plutonium homogeneity in mixed oxide pellets.** Anzo, Tomonori; Nakajima, Katsuaki; Yokosuka, Yoshifumi; Masuyama, Teikichi; Noguchi, Yukio; Yokosawa, Naoki; Kaya, Akira (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980-Mar 1981.

Plutonium homogeneity in mixed oxide pellets is one of the major inspection items. The inspection was carried out by means of a conventional α-autoradiography. It is a technique of detecting α-ray damage on a nitrocellulose film; however, careful operation is required for radiological protection and many of the operation processes. For the sake of easy and efficient operation, a α-ray radiation source photographing device has been developed. The technique consists of the application of scintillation of ZnS(Ag) through α-ray radiation. With this photographing device, plutonium spots as well as uranium spots are clearly photographed from outside the glove box without inserting film therein and without darkening the operation room. This technique makes possible the study of the plutonium homogeneity of pellets for both the FBR and ATR types. In the case a prompt study is necessary, this technique is applicable to green pellets. For the development of this technique, many studies have been made to enable the precise measurement of spot-size plutonium. A brief review of the results are presented in the following.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 0508004729

4340 (CONF-840413—13-Draft) **Elements of an advanced integrated operator control station.** Clarke, M.M.; Kreifeldt, J.G. (Clarke Ambrose, Inc., Knoxville, TN (USA); Tufts Univ., Medford, MA (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002572.

From Topical meeting on robotics and remote handling in hostile environments; Gatlinburg, TN, USA (23 Apr 1984).

One of the critical determinants of peformance for any remotely operated maintenance system is the compatibility achieved between elements of the man/machine interface (e.g., master manipulator controller, controls, displays, etc.) and the human operator. In the Remote Control Engineering task of the Consolidated Fuel Reprocessing Program, considerable attention has been devoted to optimizing the man/machine interface of the operator control station. This system must be considered an integral element of the overall maintenance work system which includes transporters, manipulators, remote viewing, and other parts. The control station must reflect the integration of the operator team, control/display panels, manipulator master controllers, and remote viewing monitors. Human factors principles and experimentation have been used in the development of an advanced integrated operator control station designed for the advance servomanipulator. Key features of this next-generation design are summarized in this presentation. 7 references, 4 figures.

4341 (CONF-841013—1) **Advancement of remote systems technology: past perspectives and future plans.** Feldman, M.J.; Hamel, W.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002556.

From Seminar on remote handling equipment for nuclear fuel cycle facilities; Harwell, Oxfordshire, UK (2 Oct 1984).

In the Fuel Recycle Division, Consolidated Fuel Reprocessing Program, at the Oak Ridge National Laboratory, a comprehensive remote systems development program has existed for the past five years. The new remote technology under development is expected to significantly improve remote operations by extending the range of admissible remote tasks and increasing remote work efficiency. The motivation and justification for the program are discussed by surveying the 40 years of remote operating experience which exists and considering the essential features of various old and new philosophies which have been, or are being, used in remote engineering. A future direction based upon the Teletec concept is explained, and recent progress in the development of an advanced servomanipulator-based maintenance concept is summarized to show that a new generation of remote systems capability is feasible through advanced technology. 20 references, 9 figures, 1 table.

4342 (CONF-841013—2) **Control room concept for remote maintenance in high radiation areas.** Clarke, M.M.; Kreifeldt, J.G. (Clarke Ambrose, Inc., Knoxville, TN (USA); Tufts Univ., Medford, MA (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002458.

From Seminar on remote handling equipment for nuclear fuel cycle facilities; Harwell, Oxfordshire, UK (2 Oct 1984).

This paper summarizes the design of a control room concept for an operator interface with remote maintenance equipment consisting of force-reflecting manipulators, tools, hoists, cranes, cameras, and lights. The design development involved two major activities. First, detailed requirements were defined for foreseeable functions that will be performed by the control room operators. Second, concepts were developed, tested, and refined to meet these requirements. 6 references, 3 figures.

4343 (CONF-841099—4) **Control room concept for remote maintenance in high radiation areas.** Clarke, M.M.; Kreifeldt, J.G. (Clarke Ambrose, Inc., Knoxville, TN (USA); Tufts Univ., Medford, MA (USA)). 1984. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002478.

From Human Factors Society annual meeting; San Antonio, TX, USA (22 Oct 1984).

This paper summarizes the design of a control room concept for an operator interface with remote maintenance equipment consisting of force-reflecting manipulators, tools, hoists, cranes, cameras, and lights. The design development involved two major activities. First, detailed requirements were defined for foreseeable functions that will be performed by the control room operators. Second, concepts were developed, tested, and refined to meet these requirements. Each of these activities is summarized below. 6 references, 3 figures.

4344 (ETR—318, pp 1-7) **Eurochemic, origin and main stages.** Huet, P. (Counsel of State, Paris (France)). 1984. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number TI85780073. (CONF-8306235—).

From Eurochemic experience; Mol, Belgium (9 Jun 1983).

The big stages in the life of the Eurochemic starting from the beginning of the negotiations in 1956 are reviewed.

4345 (ETR—318, pp 9-13) **Eurochemic experience concerning the institutional aspects of the international cooperation on scientifical and technical matter.** Strohl, P. (Nuclear Energy Agency, 75 - Paris (France)). 1984. (In French). NTIS (US Sales Only), PC A11/MF A01. File Number TI85780073. (CONF-8306235—).

From Eurochemic experience; Mol, Belgium (9 Jun 1983).

A rapid synthesis of the institutional aspects regarding the legal articles, the management and the financing of the Company is given.

4346 (ETR—318, pp 15-28) **Eurochemic and the law of the host country.** Busekist, O. von (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number TI85780073. (CONF-8306235—).

From Eurochemic experience; Mol, Belgium (9 Jun 1983).

The problematics of the convention on the constitution of Eurochemic and the statute of the company, the commercial law,

the fiscal regime, the language problem as well as the labour relations are discussed.

4347 (ETR—318, pp 29-36) **United States - Eurochemic assistance programme.** Shank, E.M. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number TI85780073. (CONF-8306235—).

From Eurochemic experience; Mol, Belgium (9 Jun 1983).

A review of the personal experience in the Eurochemic Company is given by the author.

4348 (ETR—318, pp 37-43) **Construction and startup of the reprocessing plant.** Barendregt, T. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number TI85780073. (CONF-8306235—).

From Eurochemic experience; Mol, Belgium (9 Jun 1983).

The construction and the startup of the Eurochemic reprocessing pilot plant is presented.

4349 (OEFZS—4281) **Dissolution of irradiated HTR-LEU fuel particles.** Reitsamer, G.; Stolba, G.; Falta, G.; Strigl, A.; Zeger, J.; Maly, V. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Jul 1984. 21p. (In German). (CH—334/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780090.

The PyC-coatings of irradiated HTR-fuel particles from AVR fuel elements were burnt off by air and oxygen at 1120K (comparable to the current HTR Head-End). Experiments on the solubility of this LEU-fuel proved that 99.93 % of the uranium and 99.84 % of the plutonium can be dissolved by 7 n HNO_3. After additional treatment with 7 n HNO_3/0.01 n NaF only 0.01 % of the original amount of uranium and 0.01 % of the original amount of plutonium remain undissolved. Neither the insoluble residues nor the very small amounts of solids formed on standing of the nitric acid solutions (before and after concentrating the solution up to 200 g U/l and acidity of 3 n HNO_3) showed any enrichment of plutonium compared with the nitric acid solution. Thus the results indicate that LWR-PUREX-technology can be used for reprocessing HTR-LEU-fuel.

4350 (PNCT—831-81-01, pp 100-109) **Iodine behavior in FBR spent fuel reprocessing, (1). Dissolving process simulation experiment.** Ojima, Hisao; Takasu, Nobuyuki; Ochiai, Ken-ichi; Hoshino, Tadaya (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980 - Mar 1981.

The simulation experiment has been carried out to study the iodine behavior in the reprocessing of FBR spent fuel, on both the beaker scale and the engineering scale. The dissolving rate of UO_2 pellets with HNO_3 and the iodine addition rate were measured for some concentration of HNO_3 at the condenser temperature of 20 and 50° C. The test for determining the chemical form of the iodine remaining in the dissolver was also carried out. The results obtained were as follows. (1) The DF of iodine in the dissolving process was greater than 10^3 at the nitric acid concentration lower than 3.5 N. (2) The quantity of residual iodine was not affected by the uranium dissolution method and the uranium concentration. (3) The high temperature condensation method was able to suppress iodine reflux from the condenser to the dissolver.

4351 (PNCT—831-81-01, pp 110-118) **Iodine behavior in FBR spent fuel reprocessing, (2). Extraction process simulation experiment.** Ojima, Hisao; Takasu, Nobuyuki; Kuramitsu, Yasushi; Kawabe, Hideo; Hoshino, Tadaya (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980 - Mar 1981.

The iodine behavior during the extraction process has been studied to evaluate the iodine distribution in a reprocessing plant. The extraction experiment of IO_3F- and I_2 was made by using a mixer settler and a batchwise beaker scale contactor. The distribution coefficient of IO_3F- in the stripping section was not significantly affected by HNO_3 concentration, while the distribution coefficient in the extraction section was strongly dependent on the uranium concentration. The iodine decontamination factor was obtained from the mixer-settler experiment to be approximately 30. The distribution coefficient of I_2 for extraction and that for stripping were about 10 and about 40, respectively. The experiment for the iodine removal with alkaline solution was also carried out, and it was observed that the washing with NaOH was most effective for I_2 removal from solvent.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 0509005509

4352 (NUREG—0383-Vol.1-Rev.7) **Directory of certificates of compliance for radioactive materials packages. Summary report of NRC approved packages. Volume 1, Revision 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Nov 1984. 443p. NTIS, PC A19/MF A01 - GPO* $9.00. File Number TI85900340.

This directory contains a Summary Report of NRC Approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory. Shipments of radioactive material utilizing these packagings must be in accordance with the provisions of 49 CFR 173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure that they have a copy of the current approval and conduct their transportation activities in accordance with an NRC approved quality assurance program. Copies of the current approval may be obtained from the US Nuclear Regulatory Commission Public Document Room files (see Docket No. listed on each certificate) at 1717 H Street, Washington, DC 20555. Note that the general license of 10 CFR 71.12 does not authorize the receipt, possession, use or transfer of byproduct source, or special nuclear material; such authorization must be obtained pursuant to 10 CFR Parts 30 to 36, 40, 50, or 70.

4353 (NUREG—0383-Vol.3-Rev.4) **Directory of certificates of compliance for radioactive materials packages. Summary report of NRC approved quality assurance programs for radioactive material packages. Volume 3, Revision 4.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Fuel Cycle and Material Safety). Nov 1984. 127p. NTIS, PC A07/MF A01 - GPO* $5.00. File Number TI85900315.

This directory contains a Summary Report of NRC Approved Packages (Volume 1), Certificates of Compliance (Volume 2), and a Summary Report of NRC Approved Quality Assurance Programs for Radioactive Material Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on packagings which have been approved by the US Nuclear Regulatory Commission. To assist in identifying packaging, an index by Model Number and corresponding Certificate of Compliance number is included at the back of each volume of the directory. The Summary Report includes a listing of all users of each package design prior to the publication date of the directory. Shipments of radioactive material utilizing these packagings must be in accordance with the provisions of 49 CFR 173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12, it is the responsibility of the licensees to insure they have a copy of the current approval and conduct their transportation ac-

tivities in accordance with an NRC approved quality assurance program. Copies of the current approval may be obtained from the US Nuclear Regulatory Commission Public Document Room files (see Docket No. listed on each certificate) at 1717 H Street, Washington, DC 20555. Note that the general license of 10 CFR 71.12 does not authorize the receipt, possession, use or transfer of by-product source, or special nuclear material; such authorization must be obtained pursuant to 10 CFR Parts 30 to 36, 40, 50, or 70.

4354 **(PNL-SA—12576) Dry storage - past, present, and future.** Johnson, A.B. Jr,; Gilbert, E.R.; Oden, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 21p. (CONF-841094—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003115.

From International workshop on irradiated fuel storage--operating experience and development programs; Toronto, Ontario, Canada (17 Oct 1984).

Over several decades essentially all types of irradiated nuclear fuel have been shipped and/or handled under dry conditions in hot cells. Essentially all types of irradiated fuels have been stored in dry facilities, some of which began operation as early as 1964. Four major dry storage concepts have developed: concrete silos (canisters), dry wells, metal casks, and vaults. Irradiated fuel has been emplaced in and retrieved from facilities representing all four concepts. Dry storage has been conducted safely and with relatively low radiation doses to the operators. Three of the four storage concepts have been licensed, indicating that dry storage is a relatively mature technology. Currently, dry storage is expected to fill a complementary but important role to wet storage for interim storage of water reactor fuel in the US. Dry storage may fill expanded roles in future extended storage (e.g., monitored retrievable storage) and in repository disposal. It is important that dry storage functions in a cooperative climate, where experience gained in one application is assimilated into other applications. It is also important to assess prospects to integrate current storage technologies with downstream fuel cycle activities to the extent possible. 23 references, 5 figures, 3 tables.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 0510004364, 4372

4355 **(DOE/EIA—0436(84)) World nuclear fuel cycle requirements, 1984.** Steinberg, H. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Nov 1984. 90p. NTIS, PC A05/MF A01; 1 - GPO; GPO Dep. File Number DE85002875.

This report presents projections of the domestic and foreign requirements for uranium and enrichment services, as well as spent nuclear fuel discharges. These fuel cycle requirements are based on the forecasts of future commercial nuclear power capacity published in a recent Energy Information Administration (EIA) report. Four scenarios (high, middle, low, and no new reactor orders) are included for domestic nuclear power capacity and three (high, middle, and low) for countries in the World Outside Planned Economies (WOCA). In addition, 4 sensitivity cases are presented for the US lower capacity factors, reactor aging, lower tails assay, and higher burnup. Six sensitivity cases are analyzed for the WOCA countries: (1) stable, instead of improving, capacity factors for the United States and for countries in the Other country group; (2) reactor aging; (3) recycling of uranium but not plutonium from spent fuel (the three standard scenarios assume recycling of both uranium and plutonium; (4) no recycling of spent fuels; (5) lower uranium enrichment tails assay; and (6) higher fuel burnup levels. The annual US requirements for uranium and for uranium enrichment service are projected to more than double between 1985 and 2020 in the middle case, and the cumulative amount of spent fuel discharged is projected to increase approximately 10-fold. Annual uranium requirements for the WOCA nations are projected to increase by about 60% between 1985 and 2000. In contrast, a 7- to 8-fold increase in U_3O_8 and enrichment service requirements is projected for the Other WOCA country group during this time period, as its relatively small existing nuclear power capacity undergoes rapid expansion.

0520 Waste Management

REFER ALSO TO CITATION(S) 0520004335, 4391, 4392, 4393, 4396, 4398, 4401, 4709, 4743, 4792, 4919, 4964, 4965, 4975, 5037, 5412, 5567, 5591, 5593, 5595, 5596, 5597, 5599, 5600, 5602, 5604, 5607, 5608

4356 **(CONF-831047—141) Alternative techniques for low-level waste shallow land burial.** Levin, G.B.; Mezga, L.J. (Oak Ridge National Lab., TN (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002571.

From American Nuclear Society winter meeting; San Francisco, CA, USA (30 Oct 1983).

Experience to date relative to the shallow land burial of low-level radioactive waste (LLW) indicates that the physical stability of the disposal unit and the hydrologic isolation of the waste are the two most important factors in assuring disposal site performance. Disposal unit stability can be ensured by providing stable waste packages and waste forms, compacting backfill material, and filling the void spaces between the packages. Hydrologic isolation can be achieved though a combination of proper site selection, subsurface drainage controls, internal trench drainage systems, and immobilization of the waste. A generalized design of a LLW disposal site that would provide the desired long-term isolation of the waste is discussed. While this design will be more costly than current practices, it will provide additional confidence in predicted and reliability and actual site performance.

4357 **(CONF-831063—15) Department of Energy Low-Level Waste technology development program.** Chee, T.C.; Mezga, L.J. (Department of Energy, Washington, DC (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002455.

From American Institute of Chemical Engineers fall annual meeting; Washington, DC, USA (30 Oct 1983).

The technology development program addresses four technical areas: (1) waste treatment, packaging, and handling; (2) improved shallow land burial; (3) corrective measures; and (4) greater confinement disposal. Technology development activities in the areas of shallow land burial practices and waste treatment are aimed principally at managing about 90% of the LLW generated today. Greater confinement disposal relates to about 10% of LLW remaining that has a higher hazard and may require an appropriately higher degree of confinement. Corrective measures are aimed at correcting inadequate performance at closed sites. Of these four technology areas, the major emphasis is placed on developing improved shallow land burial technology development activities with humid site work being conducted at Oak Ridge National Laboratory and Savannah River Laboratory. Arid site activities are being conducted at Los Alamos National Laboratory and Pacific Northwest Laboratory.

4358 **(CONF-841157—14) Functions of the Materials Review Board.** Steindler, M.J.; Seefeldt, W.B. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002547.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The DOE has established a centralized organization for the assembly and critical review of materials data that are important to the process of licensing a nuclear waste repository. The MRB serves as an independent reviewing body, somewhat similar to standards organizations, that examines test methods and materials data. To a large extent, the criteria used in these reviews are codified, and the review process is highly visible and extensively documented. Approval of test methods or materials data for publication in the Nuclear Waste Materials handbook requires successful completion of three separate reviews that are sufficiently rigorous, yet in accord with the provisions of the NRC licensing approach, so that the resulting documents can be used by DOE with assurance that scientific scrutiny by others will affirm the conclusions of the MRB. The credibility of the review process is reflected in the credibility of the conclusions drawn from the data, thereby allow-

ing the licensing of the repository to proceed expeditiously. 10 references.

4359 **(DOE/AL/13126—T1) Koch Process Systems VR-System 350. Technical support document.** (Koch Process Systems, Westborough, MA (USA)). 31 Dec 1981. Contract AC04-80AL13126. 188p. NTIS, PC A09. File Number DE85001795.

This document presents a conceptual design of a volume reduction system for solid and liquid combustible low-level wastes generated by either PWR or BWR nuclear power plants. The heart of the system is the controlled-air incinerator process which was developed and demonstrated by Los Alamos National Laboratory (Los Alamos) for use in the volume reduction of transuranic (TRU) waste. Equipment descriptions of sub-systems and supporting services are included with sizing basis. Instrument control philosophy is described for the system to be operated unattended. The system configuration, design, and analysis of releases are included to represent a system which is effective, flexible, safe, considers ALARA, and has all the basic needs for ultimate licensing by a utility. 18 references, 13 tables.

4360 **(DOE/LLW—18T-Rev.5) Radioactive waste management: a summary of state laws and administration. National Low-Level Radioactive Waste Management Program. Revision 5.** (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1984. Contract AC07-76ID01570. 543p. NTIS, PC A23/MF A01; GPO Dep. File Number DE85000643.

This updated report covers the administration, the legislature and the laws in the 50 states related to radioactive waste. The report for each state is divided into four sections: Cover Page; Administrative; Legislative; and Applicable Legislation. In general, the information in this report is accurate as of 31 August 1984.

4361 **(DOE/NE/44301—1) Generic requirements for a mined geologic disposal system.** (Weston (Roy F.), Roslyn, NY (USA)). Sep 1984. Contract AC01-83NE44301. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85002426.

Detailed investigations for suitable Mined Geologic Disposal System (MGDS) sites are currently underway in four different geologic host media - basalt, crystalline rocks, salt, and tuff. Four projects have been organized within the Office of Geologic Repository (OGR) Program to carry out these media-specific investigations. In order to ensure that each project's efforts are consistent with OGR Program objectives and are documented and presented on a comparable basis, the generic requirements document has been developed. It gives a functional description of the generic structure of an MGDS to convey to the projects a minimum set of requirements that must be satisfied without unduly constraining individual design efforts.

4362 **(DOE/OR/21400—T60) Radioactive waste and nuclear power: a personal perspective.** Notz, K.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 72p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002485.

An overview is given of all major sources of radioactive materials in this country, including spent fuel, high-level waste, TRU waste, low-level waste, mill tailings, remedial action programs, decontamination and decommissioning, and airborne waste. These materials are characterized in terms of location, volume, age, radioactivity, thermal power, physical properties, and chemical properties. The role of nuclear power in an oxidized and oxidizing world is discussed in terms of environmental benefits and the conservation of our limited supply of chemically reduced matter; i.e., material that can be oxidized or burned.

4363 **(DOE/ORO—5003089) Department of Energy Environmental Management Plan for Oak Ridge Reservation.** (USDOE Oak Ridge Operations Office, TN). 29 Feb 1984. 147p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85003089.

The Environmental Program Management Plan for the Oak Ridge Complex was prepared in response to recommendations made at the Congressional hearing held in Oak Ridge on July 11, 1983, to discuss the extent and impact of mercury and other pollutants from DOE's Oak Ridge facilities. While this is a planning document and not a commitment of funds, this effort will help to focus DOE resources toward resolving environmental problems at Oak Ridge in a timely and cost-effective manner. The plan includes: (1) an environmental planning basis; (2) a brief description of the problems and proposed resolutions for each plant; (3) research and development requirements and funding schedules; (4) funding schedule summaries; and (5) continuing analyses and unresolved issues. The planning basis provides the foundation for identifying the environmental problems and their potential resolutions. While applicable environmental standards must be met, there is considerable latitude for interpretation of existing regulations and projection of future requirements. This latitude can have a significant impact on funding and scheduling. 11 figures, 8 tables.

4364 **(DOE/S—0032) Cash management policies and procedures. Nuclear waste fund.** (USDOE Office of Civilian Radioactive Waste Management, Washington, DC). Nov 1984. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002712.

The purpose of this Cash Management Plan is to set forth cash management requirements for the Nuclear Waste Fund (NWF). In simple terms, effective cash management includes the development and implementation of procedures and practices to efficiently utilize the NWF cash resources and to seek improvements which cause a one-time or continuing reduction in the need to borrow from the US Treasury. Generally, the methods commonly used to achieve these objectives include accelerating collections, optimizing the timing of disbursements, eliminating excessive letter-of-credit cash balances, and investing excess cash to maximize interest earned.

4365 **(DP-MS—84-47) Greater confinement disposal program at the Savannah River Plant.** Towler, O.A.; Cook, J.R.; Peterson, D.L.; Reddick, J.A. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 14p. (CONF-841187—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002829.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

A facility to demonstrate Greater Confinement Disposal (GCD) of low-level solid radioactive waste in a humid environment has been built and is operating at the Savannah River Plant (SRP). GCD practices of waste segregation into high and low activity concentrations, emplacement of waste below the root zone, waste stabilization, and capping are being used in the demonstration. Activity concentrations to select wastes for GCD are based on the volume/activity distribution of low-level solid wastes as obtained from SRP burial records, and are equal to or less than those for Class B waste in 10 CFR 61. The first disposal units constructed are twenty 9-ft-diam, 30-ft-deep boreholes. These holes will be used to dispose of wastes from the production reactors, tritiated wastes, and selected wastes from offsite. In 1984, construction will begin on an engineered GCD trench for disposal of boxed waste and large bulky items that meet the activity concentration criteria. 4 references, 5 figures, 2 tables.

4366 **(EUR—8812) Development of computation methods and models of thermomechanical interaction of salt and storage well casing or stored wastes.** Pudewills, A.; Korthaus, E. (Commission of the European Communities, Luxembourg). 1984. 245p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85780219.

The aim of this work is the development of computation methods and models for the analysis of thermomechanical behaviour of materials in the ultimate disposal by high level radioactive wastes in rock salt.

4367 **(EUR—8922) Study of deep fractures of granitic rocks: structural study of Saint-Sylvestre granite fractures (Fanay-Augeres and Margnac Mines, Haute-Vienne, France).** Bles, J.L.; Dutartre, P.; Feybesse, J.Y.; Gros, Y.; Martin, P. (Commission of the European Communities, Luxembourg). 1984. 208p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85780220.

Radioactive waste disposal in deep geologic formation requires a good knowledge of the host rock characteristics. The present study, concentrated on granitic formations, looks for extrapolation in deep underground of fracturation data obtained at the surface.

4368 **(FLPU—83-4) Geomicrobiology of the Harwell and Altnabreac boreholes.** Christofi, N.; West, J.M.; Robbins, J.E.; McKinley, I.G. (Institute of Geological Sciences, Harwell (UK). Fluid Processes Unit). Jan 1983. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780203.

Waste repositories in deep environments are likely to contain autochthonous and allochthonous microbial populations which may influence near and far-field conditions. Studies of boreholes in argillaceous and crystalline formations at research sites in the U.K. have revealed the presence of several types of contaminant microorganisms which could affect the integrity of materials used in repository construction, alter the geochemistry and may encourage the release of radionuclides from the near-field environment.

4369 **(HEDL-TC—2353-3) Test plan for Series 2 spent fuel cladding containment credit tests.** Wilson, C.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76FF02170. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002693.

This test plan describes a second series of tests to be conducted by Westinghouse Hanford Company (WHC) to evaluate the effectiveness of breached cladding as a barrier to radionuclide release in the NNWSI-proposed geologic repository. These tests will be conducted at the Hanford Engineering Development Laboratory (HEDL). A first series of tests, initiated at HEDL during FY 1983, demonstrated specimen preparation and feasibility of the testing concept. The second series tests will be similar to the Series 1 tests with the following exceptions: NNWSI reference groundwater obtained from well J-13 will be used as the leachant instead of deionized water; fuel from a second source will be used; and certain refinements will be made in specimen preparation, sampling, and analytical procedures. 12 references, 5 figures, 5 tables.

4370 **(INIS-mf—9066) Co-ordinated research and environmental surveillance programme related to sea disposal of radioactive waste. Progress report at the end of 1983.** (Nuclear Energy Agency, 75 - Paris (France)). 1984. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703300.

Sea disposal operations of packaged low-level radioactive waste are carried out under the provisions of the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, also referred to as the London Dumping Convention. The environmental impact of this disposal method is continuously kept under review, in particular within the IAEA which has provided the "Definition of High-Level Radioactive Waste or Other High-Level Radioactive Matter Unsuitable for Dumping at Sea" for the purpose of the Convention and within the OECD-NEA in the framework of its Multilateral Consultation and Surveillance Mechanism for Sea Dumping of Radioactive Waste. The NEA Coordinated Research and Environmental Surveillance Programme (CRESP) is focussed on the actual North-East Atlantic dump site. Its objective is to increase the available scientific data base related to the oceanographic and biological characteristics of the dump site and elaborate a site specific model of the transfers of radionuclides to human populations. Future site suitability reviews, as periodically requested under the terms of the Multilateral Consultation and Surveillance Mechanism, will therefore be based on a more accurate and comprehensive scientific basis.

4371 **(LBL—17635) Rock mechanics issues and research needs in the disposal of wastes in hydraulic fractures.** Doe, T.W.; McClain, W.C. (Lawrence Berkeley Lab., CA (USA); RE/SPEC, Inc., Rapid City, SD (USA)). Jul 1984. Contract AC03-76SF00098. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001399.

The proposed rock mechanics studies outlined in this document are designed to answer the basic questions concerning hydraulic fracturing for waste disposal. These questions are: (1) how can containment be assured for Oak Ridge or other sites; and (2) what is the capacity of a site. The suggested rock mechanics program consists of four major tasks: (1) numerical modeling, (2) laboratory testing, (3) field testing, and (4) monitoring. These tasks are described.

4372 **(NP—5900193) Nuclear waste disposal: achieving adequate financing.** (Congressional Budget Office, Washington, DC (USA)). Aug 1984. 71p. NTIS, PC A04/MF A01. File Number DE85900193.

Two underground repositories will be built with sufficient disposal capacity to contain all high-level radioactive waste from commercial power reactors through at least 2020. Disposal will begin in 1998. The waste disposal program will be financed through a fee now set at 1 mill/kWh of electricity produced from commercial reactors (roughly 1.5% of the average residential price of electricity in 1983). The fee was instituted on April 7, 1983. One-time fee assessments will also be levied on the spent fuel inventories that existed before April 7, 1983. Fee proceeds, deposited in the Nuclear Waste Fund, are to be disbursed as development and construction of the disposal sites progress. Although actual construction of the sites will not begin until the 1990s, revenues must be collected now and over the construction period to finance the program in later years, when costs will often exceed annual fee receipts. Therefore, this study addresses three questions: Is the current fee adequate to finance the development, construction, and operation of the permanent radioactive waste disposal facilities under different assumptions about the growth rates of nuclear power? What adcustments must be made to the fee to provide for possible contingencies, such as program delays, changes in costs, and different inflation rates? What are the alternatives for revising the fee to ensure full cost recovery? The Congressional Budget Office found that, if the fee it adjusted annually to maintain a real (inflation-adjusted) rate of 1 mill/kWh, it should provide more than sufficient revenues to cover fully all program costs under all nuclear-growth forecasts. Indexing the fee to offset inflation beginning in 1984 also would protect the fund from cost overruns of 30% to 80%.

4373 **(NPC(W)R—760) Computer models for nuclide migration from radioactive waste repositories.** Locke, J. (National Nuclear Corp. Ltd., Whetstone (UK)). Mar 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780221.

The object of this study is to assess the possible release of radionuclides from shallow trench repositories by interaction with groundwater. To achieve this aim an appreciation of the strategy of computer modelling was required and in the course of this work some calculations will be carried out using a simple computer model. A review of the literature on nuclide migration models was therefore carried out which covered the basic theory, data requirements and limitations of use of such models. This review is by no means a complete survey of existing codes but is intended as a guide to the mathematical basis of the models for the non-specialist, indicating those parameters which influence the eventual radionuclide release. At this stage a very sophisticated model is not required, and therefore this review has concentrated mainly on simple, one dimensional codes. Two such codes have been run for five test cases in order to compare their results with each other and with the results of other codes published in the literature.

4374 **(PB—84-232305) Preliminary studies of the total cation exchange capacity of sediments from two North Atlantic study sites.** Hydes, D.J.; Hill, N.C.; Clarke, H.; Carpenter, M.S.N. (Institute of Oceanographic Sciences, Wormley (UK)). 1983. 41p. NTIS, PC E04/MF E04.

Initially four different methods of measuring total cation exchange capacity were compared. There were two chemical methods (ammonium saturation with displacement into seawater, and barium saturation followed by replacement with magnesium) and two radiochemical methods (sodium-22 and caesium-134 saturation). The barium-magnesium and sodium-22 methods were then applied to sediment samples from Core D10164 No. 1K from the Nares Fracture Valley, and Core D10554 No. 11K from the eastern flank of the Great Meteor Rise. The material at site 10164 is a pelagic clay whereas at site 10554 it is carbonate ooze. Measured exchange capacities are lower than in coastal sediments. In deep sea sediments organic matter either makes a very small contribution to the T.C.E.C. (core 10164) or actually blocks exchange sites (Core 10554). Amorphous oxides of iron and manganese contribute between 20 and 50% of the T.C.E.C.

4375 **(PB—84-232982) King's Trough Flank: geological and geophysical investigations of its suitability for high-level radioactive waste disposal.** Kidd, R.B.; Searle, R.C.; Weaver, P.P.E.; Jacobs, C.L.; Huggett, Q.J. (Institute of Oceanographic Sciences, Wormley (UK)). 1983. 113p. NTIS, PC E07/MF E07.

The King's Trough Flank study area in the Northeast Atlantic Ocean was chosen in 1979 as a location at which to examine the suitability of pelagic carbonate sequences for sub-seabed disposal of high-level radioactive waste. This report summarizes investigations up to the end of 1982; following visits by four research ships to the area during which geophysical data and sediment samples were collected. The region is a characteristically rugged portion of the deep ocean floor with hills and scarps 10 to 30 km apart and slopes around the hills ranging from 18 degrees to 30 degrees. Areas of relatively smooth seafloor occur, however, up to 35 km across, where slopes no greater than 2 degrees are recorded. At this stage an apparent discrepancy between the geophysical and sediment core data leaves some uncertainty regarding the stability of the sediment cover and the likelihood of current erosion in these areas. The general suitability of the area is discussed by comparing our present geological and geophysical data with the set of 'desirable characteristics' for a sub-seabed disposal site first outlined in 1979. The difficulties involved in extrapolating findings from presently-sampled depths of up to 10 meters to depths envisaged for shallow waste disposal are emphasized.

4376 (PNCT—831-81-01, pp 51-61) **Acid digestion of chlorine-containing wastes, (3). Engineering study of acid digestion.** Kagawa, Akio; Miyazaki, Hitoshi; Mizuno, Ryukichi; Ohtsuka, Katsuyuki (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works); Mochizuki, Yasumasa. Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980-Mar 1981.

Along with the R and D efforts on the treatment of plutonium-contaminated waste materials for volume reduction and stabilization at PNC, studies have been conducted for the development of the technology related to the acid digestion treatment utilizing sulfuric acid and nitric acid. This report describes the treatment capacity, the treatment of decompocsed gas, and the properties of the reduced residues following the treatment. The process involves two steps: the decomposition employing sulfuric acid and the oxidation utilizing nitric acid. The treatment capacity during reaction is influenced by the foaming of the acid digestion solution for the H_2SO_4 decomposition process. A series of experiments were carried out on H_2SO_4 decomposition reaction by feeding the crushed samples of 10 mm size into hot sulfuric acid (250 degree C) continuously under a pressure of 100 mm aq. The foaming of the acid digestion solution is closely related to the concentration of solids such as carbon and inorganic materials. Addition of nitric acid to the H_2SO_4 decomposition process is effective for controlling the foaming of the acid digestion solution. The influence of initial nitric acid concentration upon sulfur oxide oxidation-absorption is very small when the nitric acid concentration is in the range from 14 to 32 percent.

4377 (PNCT—831-81-01, pp 68-86) **Vitrification of high level liquid waste, (3). Research on composition and characterization of high-level waste glass.** Torata, Shin-ichiro; Igarashi, Hiroshi; Kawanishi, Nobuo; Nagaki, Hiroshi; Tsunoda, Naomi (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980-Mar 1981.

The fundamental research on the glass composition most suitable to solidify HLLW from the PNC's reprocessing plant has been performed. A reference glass was developed under the limited melting temperature of 1200 degree C and the limited leaching rate of 10^{-5} g/cm^2. day into distilled water at 100 degree C. The characterization of this glass has been performed from the standpoint of waste management and plant operation. In this report, the chemical durability of the reference glass was examined under static and dynamic conditions. The reference glass had good tolerance for the change in waste composition and content. As for the mechanical integrity, the reference glass was also recognized to be comparable with commercial glass. The decrease in density was observed in the sample irradiated with electrons. The addition of SiO_2 and BaO to modify the reference composition was found to be valid for the improvement of the reference glass.

4378 (PNCT—831-81-01, pp 87-99) **Development of the vitrification process of high-level liquid waste in the engineering test facility.** Zaitsu, Tomohisa; Inada, Eiichi; Sasaki, Noriaki; Nagaki, Hiroshi; Tsunoda, Naomi (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980-Mar 1981.

The engineering test facility has been constructed to establish the vitrification process for high level liquid wastes (HLLW). Two campaigns with the simulated HLLW containing 3 mol/l of nitric acid have been conducted to confirm the facility performance and to grasp the operation mode. The facility includes a pretreatment system, an off-gas treatment system, Joule heated ceramic melters and a canister-handling system. In two campaigns, approximately 50 m^3 of the simulated HLLW were treated, and 18.5 tons of the borosilicate glass containing about 30 percent of the waste oxides were produced. The maximum gas evolution rate during denitration is dependent on the feed rate of formic acid and the quantity of waste solution. The data in the engineering scale experiment were in good agreement with those in the laboratory scale experiment. Various heating tests were performed for the melters. Investigation was made on the corrosion of the electrodes and refractories. The corrosion of the molybdenum electrodes was observed. The analysis of the particulates deposited inside the off-gas lines showed that the chemical composition of the particulates generated during slurry feeding agreed well with the composition of glass product and particulates during the operation held in the melters. The removal efficiency of NO_2 was measured.

4379 **(PNL-SA—12283) Selection of a reference process for treatment of the West Valley alkaline waste.** Holton, L.K.; Wise, B.M.; Bray, L.A.; Pope, J.M.; Carl, D.E. (Pacific Northwest Lab., Richland, WA (USA); West Valley Nuclear Services Co., Inc., West Valley, NY (USA)). Aug 1984. Contract AC06-76RL01830. 21p. (CONF-840802—25). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002539.

From ANS International topical meeting on fuel reprocessing and waste management; Jackson Hole, WY, USA (26 Aug 1984).

As part of the West Valley Demonstration Project (WVDP) the alkaline PUREX supernatant stored in Tank 8D2 will be partially decontaminated by the removal of radiocesium. Four processes for removal of radiocesium from the alkaline supernatant were studied through experimentation and engineering analysis to identify a reference approach for the WVDP. These processes included the use of a zeolite inorganic ion-exchanger (Linde Ionsiv IE-95), an organic ion exchange resin (Duolite CS-100), and two precipita-

tion processes; one using sodium tetraphenylboron (NaTPB) and the other using phosphotungstic acid (PTA). Based upon process performance, safety and environmental considerations, process and equipment complexity and impacts to the waste vitrification system, the zeolite ion-exchange process has been selected by West Valley Nuclear Services, Inc., as the reference supernatant treatment process for the WVDP. This paper will summarize the technical basis for the selection of the zeolite ion-exchange process. 4 figures, 2 tables.

4380 **(RHO-BW-SR—84-1-1Q-P) Basalt Waste Isolation Project drilling and testing. Quarterly report, January 1-March 31, 1984.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). May 1984. Contract AC06-77RL01030. 59p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85003171.

The Drilling and Testing Group at Rockwell Hanford Operations is responsible for all borehole drilling and testing conducted in support of the Basalt Waste Isolation Project. Geologic and hydrologic characterization data obtained by the group are an integral part of the studies required to determine the feasibility of using the deep basalts beneath the Hanford Site for the terminal disposal of nuclear waste. This document is a summary of drilling and testing during the first calendar quarter (January through March 1984). The principal work during this period included the drilling and/or testing of the piezometer borehole clusters. Specific highlights of this work are summarized. 5 references, 21 figures, 6 tables.

4381 **(SAAS—313) Thermomigration of fluid inclusions in rock salt. Implications for the disposal of nuclear wastes.** Noack, W.; Runge, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1984. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780222.

A mathematical model has been suggested to predict the time-dependent accumulation of brine at nuclear waste packages emplaced in a rock salt repository owing to thermomigration of brine inclusions. The model is based mainly on a description of the migration rate as a function of the temperature, temperature gradient, inclusion size and gas/liquid ratio of inclusions. Other factors are treated merely as disturbing quantities with respect to the migration rate.

4382 **(SAND—84-2060C) US Subseabed Disposal Program radioecological data base: summaries of available radionuclide concentration factors and biological half-lives.** Gomez, L.S.; Marietta, M.G.; Jackson, D.W. (Sandia National Labs., Albuquerque, NM (USA); Scientific Information Management, Inc., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 4p. (CONF-8410182—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002624.

From Commission for the scientific exploration of the Mediterranean Sea; Lucerne, Switzerland (9 Oct 1984).

The US Subseabed Disposal Program has compiled an extensive objective concentration factor and biological half-life data base from the international marine radioecological literature. A microcomputer-based data management system has been implemented to provide statistical and graphical summaries of these data. The data base is constructed in a manner which allows subsets to be sorted using a number of inter-study variables such as organism category, tissue/organ category, geographic location (for in situ studies), and several laboratory-related conditions (e.g., exposure time and exposure concentration). We discuss concentration factor data summaries for many elements. We also discuss summary material for biological half-life data. We discuss the results of our review with the estimates of mean concentration factors provided by the IAEA. It is proposed that this presentation scheme will enable those concerned with predictive assessment of radiation dose in the marine environment to make a more judicious selection of data for a given application. 7 references.

4383 **(UCID—30206) User's guide to REVERT. A CDC 7600 program for converting Spent Fuel Test - Climax data to engineering units, with corrections.** Hage, G. (Lawrence Livermore National Lab., CA (USA)). Oct 1984. Contract W-7405-ENG-48. 51p. NTIS, PC E04/MF A01; 1; GPO Dep. File Number DE85002690.

A CDC 7600 computer program, REVERT, can revise Spent Fuel Test - Climax data files using one of several algorithms, depending on the type of data. The algorithms use coefficients from a separate file organized by data type identifiers. REVERT can also make that file of coefficients, using data from tapes made by Hewlett-Packard equipment employed for data acquisition on the spent Fuel Test - Climax at NTS. 12 references.

4384 **(UCRL—91631) PROTOCOL, a numerical simulator for the dissolution of inorganic solids in aqueous solutions.** Jackson, D.D. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 72p. (CONF-8409177—1). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85003201.

From Performance of borosilicate glass HLW forms in disposal systems workshop; Germantown, MD, USA (18 Sep 1984).

PROTOCOL is a computer software package developed for the simulation of dissolution of solid phases in aqueous solutions. It is a flexible instrument for the evaluation of both experimental and theortical approaches to the dissolution of solids. The code contains a kinetic capability to describe release from the glass, an equilibrium capability based on the geochemical code MINEQL that models solution concentrations and precipitate formation, a system monitoring capability that directs the computations through a series of discrete time increments, and a capability to estimate the standard Gibbs free energy function of disordered solid phases. Conventional solubility considerations are extended to nonstoichiometric alteration products of glasses. Many of the precipitates that form in leaching of waste glass are as yet unidentified, hydrous, poorly-ordered species that cannot be accommodated by the standard thermodynamics-based geochemical code. PROTOCOL contains a procedure to estimate the Gibbs free energies of chemical components from which the hydrous precipitates in the leached surface layer may be assumed to be composed in varying combinations.

4385 **(UTRCN-S—5) Report of the symposium on 'comprehensive research on the management of long-lived radioactive wastes' in the Research Center for Nuclear Science and Technology, University of Tokyo.** Sekiguchi, Akira; Naito, Keiji; Suzuki, Susumu; Furuya, Hirotaka; Sato, Masatomo. (Tokyo Univ. (Japan). Research Center for Nuclear Science and Technology). Jan 1983. 43p. (In Japanese). (CONF-830177—Summ.). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703301.

From Symposium on comprehensive research on the management of long-lived radioactive wastes; Tokyo, Japan (25 Jan 1983).

In the Research Center for Nuclear Science and Technology, University of Tokyo, the special research project "Comprehensive Research on the Management of Long-Lived Radioactive Wastes" is carried out in the three-year period from fiscal 1982 to 1984. In this connection, a symposium has been held on January 25, 1983. Seven lectures given by the respective speakers are summarized individually: (1) the research of transuranic elements in educational institutions, (2) an outline of the actinoid research facilities planned in Tohoku University, (3) the radiation damage and leachability of glass solids, (4) the situation and trend in Japan and abroad of the disposal of long-lived nuclide wastes, (5) practical site tests concerning the geologic-formation disposal of low-level wastes, (6) the trend in the research of geologic formations for the disposal of high-level wastes, (7) the safety in the management of long-lived radioactive wastes.

4386 **(UTRCN-S—6) Fiscal 1982 progress report of 'comprehensive research on the management of long-lived radioactive wastes' in the Research Center for Nuclear Science and Technology, University of Tokyo.** Sekiguchi, Akira; Kosako, Toshiso (eds.). (Tokyo Univ. (Japan). Research Center for Nuclear Science and Technology). 25 Mar 1983. 18p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703302.

In the Research Center for Nuclear Science and Technology, University of Tokyo, the special research project "Comprehensive Research on the Management of Long-lived Radioactive Wastes" is carried out in the three-year period from fiscal 1982 to 1984. The works performed in the fiscal year 1982 are described individually.. Buff Buffer materials in land disposal, canisters, corrosion of waste-container materials, thermal analysis of high-level wastes, effects of tritium on cells and marine life, biological effect of long-lived nuclides, separation of tritium wastes, actinoids and krypton-iodine, environmental migration of radionuclides, and accident analysis are deiscussed.

4387 **(WINCO—1021) Radiological characterization and decision analysis for the SFE-20 waste tank and vault.** Schmidt, D.A.; Moser, C.L. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Sep 1984. Contract AC07-84ID12435. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000407.

Westinghouse Idaho Nuclear Company, Inc. (WINCO), has completed a physical and radiological characterization of the SFE-20 Waste Tank Facility located at the Idaho Chemical Processing Plant (ICPP). The objectives of this characterization are to physically describe the SFE-20 tank and its related components, measure and record radiation fields, determine the radionuclide content of smearable contamination on and about the SFE-20 tank, and determine the radionuclide type and concentration in the tank contents and surface soil above the tank. A decision analysis was performed to select the best method and time frame for decommissioning the SFE-20 Tank, Vault and Pump Pit. 2 references, 14 figures, 9 tables.

4388 **Thermal stabilization of uranium mill tailings.** Dreesen, D.R.; Cokal, E.J.; Wangen, L.E.; Williams, J.M.; Thode, E.F. (Los Alamos National Lab., NM). *Environmental Science and Technology;* **18**: No. 9, 658-667(Sep 1984). Contract W-7405-ENG-36.

The treatment of uranium mill tailings by high-temperature sintering (>1050°C) has been investigated as a means of controlling the release of ^{222}Rn and leachable contaminants. Thermal stabilization in laboratory trials at 1200°C reduced the radon emanation of various tailings by factors ranging from 37 to 1400 depending on the mineralogy of the tailings. The leachability of most contaminants (e.g., Al, Cd, Mn, Pb, U, and Zn) was substantially reduced. The weathering of thermally stabilized tailings was simulated by grinding and leaching and appears dependent on the gypsum content and particle size distribution of the original tailings as well as the amount of amorphous material produced during thermal treatment. Pilot-scale thermal stabilization tests verified the technical feasibility of this conditioning process. A conceptual engineering design of a thermal stabilization operation has been developed around the use of coal-fired rotary cement kilns; economic analysis of remedial action alternatives at several inactive uranium processing sites indicates that the cost of thermal stabilization is comparable to relocating the tailings piles.

4389 **Benard C. Rusche nomination. Hearing before the Committee on Energy and Natural Resources, US Senate, Ninety-Eighth Congress, Second Session, May 17, 1984.** Washington, DC, USA; Government Printing Office (1984). 125p.

A hearing on the nomination of Benard C. Rusche to the new position of Director of the Office of Civilian Radioactive Waste Management in DOE began with an introduction and endorsement by Senator Thurmond of South Carolina. Testimony by the nominee emphasized the need to move ahead on radioactive waste disposal and storage arrangements that will provide protection for the environment and the public. His key points included the need for a common framework and an integrated program that would include opportunities for public discussion of all affected parties. He expressed a commitment to responsible and accountable procedures and cooperation with other regulatory agencies.

4390 **(WH-Trans—513) Method of final conditioning of solid radioactive wastes.** Ledebrink, F.W. (UKAEA Atomic Energy Establishment, Winfrith; Alpha Chemie und Metallurgie G.m.b.H. (ALKEM), Hanau (Germany, F.R.)). 18 Feb 1982. Translation of German Patent Application 0,032,686, 1981. 6p. NTIS, PC A02. File Number DE85900002.

Organic raw wastes are finely reduced, mixed homogeneously into a cement/water mix, poured into a storage drum, and any non-reducible wastes of an inorganic nature embedded, therein. The cured wastes are transported to the repository.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 0530004369

4391 **(CONF-841157—15) Gamma irradiation in a saturated tuff environment.** Bates, J.K.; Oversby, V.M. (Argonne National Lab., IL (USA); Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002750.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The influence of gamma irradiation on the reaction of actinide doped SRL 165 and PNL 76-68 glasses in a saturated tuff environment has been studied in a series of tests lasting up to 56 days. The reaction, and subsequent actinide release, of both glasses depends on the dynamic interaction between radiolysis effects which cause the solution pH to become more acidic and glass reaction which drives the pH more basic. The use of large gamma irradiation dose rates to accelerate reactions that would occur in an actual repository radiation field may affect this dynamic balance by unduly influencing the mechanism of the glass-water reaction. Comparisons are made between the present results and data obtained by reacting the same or similar glasses using MCC-1 and NNWSI rock cup procedures. 11 references, 3 figures.

4392 **(CONF-841157—17) NNWSI waste form performance test development.** Bates, J.K.; Gerding, T.J. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002745.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

A test method has been developed to measure the release of radionuclides from the waste package under simulated NNWSI repository conditions, and to provide information concerning materials interactions that may occur in the repository. Data from 13 weeks of unsaturated testing are discussed and compared to that from a 13-week analog test. The data indicate that the waste form test is capable of producing consistent, reproducible results that will be useful in evaluating the role of the waste in the long-term performance of the repository. 6 references, 3 figures.

4393 **(DOE/LLW—13Te) Low-level radioactive waste management handbook series: corrective measures technology for shallow land burial.** (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1984. Contract AC05-84OR21400. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85002395.

The purpose of this document is to serve as a handbook to operators of low-level waste burial sites for dealing with conditions which can cause problems in waste isolation. This handbook contains information on planning and applying corrective actions, and is organized in such a way as to assist the operator in associating problems or potential problems with causative conditions. Thus, the operator is encouraged to direct actions at those conditions, rather than the possible temporary expedient of treating symptoms. In Chapter 2 of this handbook, corrective action planning is briefly presented. Chapter 3 discusses the application of corrective measures by addressing, in separate sections, the following conditions

which can occur at burial sites: eroding trench cover; permeable trench cover; subsidence of trench; groundwater entering trenches; trench intrusion by deep-rooted plants; and trench intrusion by burrowing animals. In each of these sections, a condition is introduced and related to burial-site problems. It is followed by a discussion of alternative methods for correcting the condition. This discussion includes descriptive information, application considerations for these alternatives, a listing of potential advantages and disadvantages, presentation of generalized cost information, and in conclusion, a statement of recommendations regarding application of corrective action technologies. 66 references, 21 figures, 24 tables.

4394 **(PB—84-232669) Development of environmentally attractive leachants. Volume 2. An experimental and theoretical study of uranium and pyrite dissolution kinetics. Open file report 5 June 1978-31 July 1983.** Schechter, R.S.; Lake, L.W.; Guilinger, T.R. (Texas Univ., Austin (USA). Dept. of Petroleum Engineering). 29 Feb 1984. 549p. NTIS, PC A23/MF A01.

See also PB83-234997.

This report describes the results of flow tests on the rate and ultimate yield of uranium and pyrite leaching under conditions representative of carbonate in situ uranium leaching. The effects of cation type, pH, carbonate and oxygen concentrations, and flow rate were investigated for uranium leaching. Leachant cation, pH, and carbonate concentration has little effect on uranium leaching, but the leaching rate depended on oxidant concentration to 1/2 order. The insensitivity to cation type led to a new process whereby the leach solution is preceded by a preflush containing the chloride of the leaching cation. This preflush prevented permeability losses associated with carbonate precipitation and clay swelling caused by certain cations. The effects of leachant cation, pH, carbonate and oxidant concentration, and particle size were also studied for pyrite leaching. The reaction products were elemental sulfur, thiosulfate, sulfate, and an unidentifiable sulfur species. The fate of iron was geothite, amorphous iron, oxyhydroxides, and lepidocrocite.

4395 **(PB—84-232875) Restoration of groundwater quality after in situ uranium leaching. Open file report (final) October 1977-August 1979.** Riding, J.R.; Rosswog, F.J. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Aug 1979. 363p. NTIS, PC A16/MF A01.

In situ solution mining of uranium has several environmental advantages over other mining techniques. The leaching of uranium, however, alters the ground water in the aquifer where the leaching occurs. A requirement of the mining technique is the control of objectionable materials that are introduced into the water. This report reviews the state of the art in restoring ground water quality. Current restoration practices discussed include disposal wells and solar evaporation ponds. Sweeping techniques by producing water flow from all wells during restoration and recirculating techniques by recharging water from a surface purification plant are evaluated. Methods for predicting the effectiveness and costs of current methods are presented. Possible alternatives for restoration of the ground water quality are described.

4396 **(PNL-SA—12538) Evaluation of the performance of solidified commercial low-level wastes in an arid climate.** Graham, M.J.; Walter, M.B. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 13p. (CONF-8409115—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002525.

From 6. annual Low-Level Waste Management Program participants' information meeting; Denver, CO, USA (11 Sep 1984).

Shallow land burial is being used as a disposal method for commercial low-level waste at waste disposal sites in arid (Hanford site near Richland, Washington) and humid (Barnwell, South Carolina) climatic regions. A field lysimeter facility has been established at the Hanford site in which to conduct waste-form leaching tests. The primary objective of this research is to determine typical source terms generated by commercial solidified low-level wastes. The field lysimeter facility consists of ten 3-m-deep by 1.8-m-diameter, closed-bottom lysimeters around a central instrument caisson, 4 m in diameter. Commercial cement and vinyl ester-styrene waste samples were removed from 210-L drums and placed in the 1.8-m-diameter lysimeters. Two bitumen samples are planned to be emplaced in the facility in 1984. The central caisson provides access to the instrumentation in the individual lysimeters and allows selective sampling of the soil and waste forms. Suction candles (ceramic cups) placed around the waste will be used to periodically collect soil water samples for chemical analysis. Meteorological data, moisture content, and soil temperature are automatically monitored at the facility. Characterization of the soils and waste forms have been partially completed. These data consist of moisture release characteristics, particle size distribution, concentrations and distributions of radionuclides in the waste forms, concentrations of radionuclides in the waste streams, and concentrations of hydrophilic organic species in one of the waste steams. 8 references, 3 figures, 5 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 0540004267, 5224

4397 **(MRP/MRL—81-41(TR)) Radiation, ventilation and dust studies at Agnew Lake mines.** Bigu, J.; Gangal, M.; Knight, G.; Regan, R.; Stefanich, W. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada)). Aug 1980. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85780092.

Measurements of radon gas, radon and thoron decay products, ventilation, and aerosol (<= 0.13 μm) and respirable dust (<= 10 μm) concentrations were conducted at an underground uranium mine in the Agnew Lake, Ontario, area. Radon gas measurements were carried out with a radon gas continuous monitoring system, whereas the other variables were determined by grab-sampling techniques. Studies were conducted at three mine locations: a working stope, an exhaust area near the stope and a general intake area supplying fresh air to several stopes. Radiation and dust studies were carried out for different mining operations (mainly mucking and drilling) and environmental conditions. Underground barometric pressure did not seem to affect radon gas levels. No obvious effect on radiation and dust levels was readily observed nor could be correlated with underground meteorological data within the relatively narrow range the (meteorological) variables changed. Theoretical calculations for some radiation variables were done and compared with experimental values. Within the limitations of some of the calculations, overall fair agreement between experimental and theoretical data was found.

4398 **(NUREG/CR—3429) Borehole logging for radium-226: recommended procedures and equipment. Final report.** Olsen, K.B.; Thomas, V.W. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 43p. (PNL—5094). NTIS, PC A03/MF A01 - GPO $3.75. File Number TI85002815.

Field investigations and a literature review were conducted to determine whether existing well-logging techniques are suitable for measuring ^{226}Ra at remedial action sites. These methods include passive gamma-ray measurement techniques using NaI(Tl) and, occasionally, intrinsic germanium detectors. Parameters that must be considered when logging boreholes at remedial action sites include: (1) casing material and thickness, (2) water in the borehole, (3) borehole diameter, (4) disequilibrium between uranium and its daughters when using scintillation detectors, and (5) spatial distribution of the tailings material. Information from the uranium exploration industry demonstrates that borehole logging is a better method for estimating radionuclide concentrations in subsurface soils than core and drill cutting analysis. Field measurements using NaI(Tl) and IG detectors at Edgemont, South Dakota, have shown that NaI(Tl) detectors log boreholes faster than IGs. However, if NaI(Tl) detectors are used, additional time is required after logging to obtain representative samples of any anomalies found during logging, conform those samples to a constant geometry, and then count the samples using IG detectors to determine if the materials are tailings. 16 references, 13 figures.

4399 **(OSQ—78-00093) SF_6 ventilation study at Agnew Lake Mines, Ontario.** (MacLaren (James F.) Ltd., Willowdale, Ontario (Canada); Department of Energy, Mines and Resources, Elliot Lake, Ontario (Canada). Elliot Lake Lab.). Mar 1979. 119p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85780094.

Report to CANMET, Elliot Lake Laboratory.

In September 1978, James F. MacLaren Limited was awarded a contract by the Canada Centre for Mineral and Energy Technology (CANMET) to undertake a ventilation study at an underground uranium mine using sulphur hexafluoride (SF_6) as a tracer gas. The mine selected for the study was that of Agnew Lake Mines Limited in Northern Ontario. This is a relatively new mine with the combined mine/mill facilities first operational in mid-1977. Uranium is recovered from broken ore by in-situ leaching. The ventilation study was divided into two phases. A laboratory study was undertaken to develop a practical sampling technique, provide an evaluation of the logistics of long range sample transport and develop a laboratory analytical technique. Field programmes demonstrated the SF_6 tracer gas technique for mine ventilation troubleshooting with the intent of providing information which will lead to more efficient use of existing mine ventilation capacity. This report outlines the findings of the laboratory study and the two field programmes.

4400 (PNCT—831-81-01, pp 16-25) **Evaluation of decontamination during dismantling of plutonium-contaminated glove boxes.** Kinugasa, Manabu; Taguchi, Seigi; Ohzeki, Satoru; Inoue, Yoshiaki; Kashima, Sadamitsu (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980 - Mar 1981.

The dismantling work of plutonium-contaminated glove boxes was carried out. These glove boxes had been used for the R and D of plutonium-uranium mixed oxide fuel for 15 years. The work was carried out in a pressure-controlled greenhouse, and the contamination of air in the greenhouse was monitored continuously. In order to reduce the contamination of air during dismantling, the decontamination and fixation of loose contaminants on the surfaces of glove boxes were very important. The correlation between decontamination and the contamination of air regarding dismantling is reported in this paper. The surface contamination density of the glove boxes was measured utilizing the smear method before and after the decontamination, and the decontamination effects were estimated. The contamination of air during dismantling was continuously measured with a plutonium dust monitor. It was found that loose contamination exponentially decreased by the decontamination process. When the so-called wet glove boxes, which contained wet recovery and waste disposal apparatus, were dismantled, the contamination of air did not exceed 500 (MPC) a. However, the contamination of air exceeded 500 (MPC) a several times in the present work of dismantling the so-called dry glove boxes which had been used for the fabrication of plutonium-uranium mixed oxide pellets.

4401 **(BNL-tr—1037) Microbial processes in the final repository, the silo part. Theoretical approach and preliminary experiments on the biodegradation of bitumen. Part 1.** Roffey, R.; Hjalmarsson, K. (Brookhaven National Lab., Upton, NY (USA)). [1984]. Contract AC02-76CH00016. Translation of FOA-C 40 172-B4, May 1983. (PB—84-108919). 37p. NTIS, PC A3. File Number DE85001773.

On Commission of SKBF/KBS the microbial processes that are likely to occur in the silo part of SFR, the final repository for medium- and low-level nuclear wastes, have been put together. The experimental studies concerning microbial degradation of bitumen are described. From a microbial point of view it is the biodegradation of bitumen that constitutes the greatest risk in the silo part of SFR. The degradation, aerobic as well as anaerobic, leads to production of carbon dioxide which might cause a decrease in pH to such an extent that hydrogen-gas producing corrosion of metal could occur. This production of gas can cause an increase in internal pressure of the repository. A culture of bacteria able to degrade bitumen aerobically has been enriched. Uptil now no culture degrading bitumen under anaerobic conditions have been obtained. When making a risk assessment of the SFR at the present time it is not possible to completely disregard the microbial activity. An account is also given for some international contacts in this area. 11 references.

0550 Regulations

4402 **(DOE/DP—48013-1) Fundamental research of decision support systems. Progress report, March 1983-September 1984.** (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Management Systems Labs.). 1984. Contract AS05-83DP48013. 229p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000023.

The objective of the research effort is to investigate and formulate methods and tools to improve the decision-making processes of managers in uncertain environments by researching decision support systems (DSS). DSS was coined by researchers in the field to describe a system which integrates extensive decision analysis with a comprehensive management information system (MIS). The results of this research are expected to enhance management decision-making in uncertain environments where traditional management techniques have failed.

4403 **(IAEA-RL—79) Intercomparison samples of natural uranium dioxide SR-1 characterization of the material.** Aigner, H.; Kuhn, E.; Deron, S. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Feb 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703304.

The sample of natural uranium dioxide SR-1 was distributed in November 1977 to 37 laboratories for intercomparison of uranium determinations. The objective of this programme of the Analytical Quality Control Services of the International Atomic Energy Agency is to give to the participating laboratories an opportunity to verify the accuracy of their measurements for the purpose of uranium accountability. The participating laboratories were therefore asked to report their analyses with precisions and accuracies of +-0.1% or better. These analyses were to be compared with a reference value. This report describes how this reference value was established on the basis of the measurements performed by four analytical laboratories: IAEA Safeguards Analytical Laboratory, Vienna, Austria; Khlopin Radium Institute, Leningrad, USSR; Netherland Energy Research Foundation ECN, Petten, Netherlands; and Institute of Nuclear Research, Warsaw, Poland.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

REFER ALSO TO CITATION(S) 0701004334, 5063, 5064

4404 **(DP-MS—84-55) Development of on-line heavy water analysis by vibrating probe density meter and multiple internal reflectance infrared spectrometry.** Jones, V.D.; Nora, B. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 2 Oct 1984. Contract AC09-76SR00001. 9p. (CONF-841023—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002828.

From 27. ORNL-DOE conference on analytical chemistry in energy technology; Knoxville, TN, USA (2 Oct 1984).

Achieving high productivity in the Savannah River Plant nuclear reactors requires that the heavy water (D_2O) moderator be maintained at a high purity level. Since the D_2O purity will degrade with time, a fraction of the moderator must be continually reprocessed to remove H_2O. This rework process uses a series of fractional distillation columns. The process control is based on laboratory analyses of process samples every four hours. The sample streams, which can range from 0.10 to 99.80 mol % D_2O, are analyzed using infrared spectrophotometry. An automatic on-line analysis would provide tighter process control and reduce personnel exposure to the tritiated moderator. Two instruments are being evalu-

ated for on-line control; an Anton/Parr DPR 2000 density measuring system and a General Analysis Corporation LAN-I infrared liquid stream monitor.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 0702005107, 5128

4405 **(AD-A—143183/2) Development of an x-ray facility for radiation dosimetry studies.** Huntley, R.B. (Materials Research Labs., Ascot Vale (Australia)). Dec 1983. 61p. (MRL-R—910). NTIS, PC A04/MF A01.

An X-ray test facility is described which provides photon beams of sharply-defined energy in the range 5 to 250 keV. Methods adopted include the use of composite filters and radiator foils. Characteristics of the radiation beams are established, including their intensities, energy spectra, and transverse uniformities, and a novel operating chart is presented. The facility may be employed for a wide range of radiation experiments, and its application to the testing and calibration of civilian, military, and civil defence radiation measuring instruments is considered in detail.

4406 **(AECL—7504) Review of the present status of food irradiation.** Beddoes, J.M. (Atomic Energy of Canada Ltd., Ottawa, Ontario. Commercial Products). Jun 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780101.

French version included as AECL--7504F.

Investigations into the potential of food irradiation as a major food processing technology have been underway for over twenty years. Considerable progress has been made in the areas of its science and technology, its governmental and international regulation, its acceptance by consumers, and its economic impact on the cost of food. The paper reviews some of the major steps taken in food irradiation and predicts that it will become a new world wide application of technology in the 1980's.

4407 **(REG/G—10.9) Guide for the preparation of applications for licenses for the use of self-contained dry source-storage irradiators. Second proposed Revision 1.** Bassin, N. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Oct 1984. 22p. NTIS, PC A02/MF A01 - GPO*. File Number TI85900189.

The purpose of this regulatory guide is to provide assistance to applicants and licensees in preparing applications for new licenses, license amendments, and license renewals for the use of self-contained dry source-storage irradiators. These irradiators are constructed so that the sealed sources and the material being irradiated are contained in a shielded volume and there is no external radiation beam during the use of the irradiator. The radioisotopes most commonly used for these irradiators are cobalt-60 and cesium-137.

0703 Isotopic Power Supplies

4408 **(AD-A—142937/2) Power flattening techniques for radioisotopic thermoelectric generators. Interim report 1 December 1983-16 March 1984.** Eastman, G.Y. (Thermacore, Inc., Lansaster, PA (USA)). 11 Mar 1984. 58p. NTIS, PC A04/MF A01.

The objective of this program is the investigation of a novel means of reducing the potential ecologic hazards that may be associated with radioisotopic thermoelectric generators (RTG's). A number of short lived isotopes have lower toxicities and are more ecologically acceptable than the Plutonium 238 used at present. In addition, the shorter half lives significantly reduce the time period during which isotope encapsulation must be assured (approx. 10 half lives). The technical approach involves the use of a gas controlled heat pipe to maintain a nearly constant heat input to the thermoelectric converter in spite of the decay profile of a short live heat pipe-RTG system is expected to operate over at least two isotope half lives (4:1 turndown ratio), supplying a thermoelectric module with the heat required to generate one watt of electricity. The end product of the program is a proof of principle heat pipe demonstrating the desired heat transport and turndown capability. The program has three items of work: Survey of Technology Base; Design of Proof of Principle Heat Pipe; Heat Pipe Fabrication and Test.

08 HYDROGEN

0801 Production

4409 **(BMFT-FB-T—84-146) Development and test of thin film electrolysis cells for high temperature water vapour electrolysis.** Dietrich, G.; Hermeking, H.; Koch, A.; Mueller, J.C.; Schaefer, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752272.

The goal of this project was to manufacture advanced high temperature electrolysis (HTE) cells with high efficiency using thin ZrO_2/Y_2O_3 solid oxide electrolytes. The HTE cells were to be tested under real electrolysis conditions. The electrolytes were to be prepared by the electrochemical vapour deposition (EVD) method already developed in a first phase of the project (BMFT - FB T 81- 143). The advanced EVD method allowed a reproducible deposition of electrolytes, which satisfied the requirements with regard to composition, crystal structure, oxygen ion conductivity and gas-tightness under operating conditions of HTE. By this technique tubular cells could be manufactured allowing a simple gas inlet system and an easy electrical series connection of single cells. The expectations for reduced ohmic losses in such thin film cells could be clearly satisfied by electrolysis experiments. Considerations about the electrical series connection of single thin film cells showed, that in comparison to a self supporting construction the losses of electrodes and interconnections can be further reduced by a suitable connection technique and a more favourable geometry. The presented results demonstrate, that the HTE can be further improved by the thin film technique. At the same losses these improvements lead to increased current densities and/or decreased operating temperature.

4410 **Electrodeposition of nickel and cobalt oxides onto platinum and graphite electrodes for alkaline water electrolysis.** Chen, Y.W.D.; Noufi, R.N. (Solar Energy Research Institute, Golden, Colorado). *Journal of the Electrochemical Society;* **131**: No. 6, 1447-1451(Jun 1984).

Smooth, compact, and bright films of nickel and cobalt oxides were prepared from 0.5M acetate aqueous solutions and electrodeposited onto platinum and graphite electrodes. Oxygen evolution potentials in 1M NaOH at room temperature were about 150-170 mV lower on nickel(III) oxide (NiO(OH)) and cobalt(III) oxide (Co_2O_3) coated anodes than on bare anodes. Scanning electron micrographs of NiO(OH) deposits showed no morphological change after extensive electrolysis, and electrocatalytic activity was stable in long-term controlled-potential coulometric electrolysis. However, the electrocatalytic activity of Co_2O_3 showed initial decay followed by a fairly constant behavior. No visible change in the surface of the Co_2O_3 deposit was observed after extensive electrolysis.

4411 **Performance requirements of an inertial fusion energy source for hydrogen production.** Hovinjh, J. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94566). *Nuclear Technology/Fusion;* **4**: No. 2, 173-177(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

Performance of an inertial fusion system for the production of hydrogen is compared to a tandem mirror system hydrogen producer. Both systems use the General Atomic sulfur-iodine hydrogen production cycle and produce no net electric power to the grid. An ICF-driven hydrogen producer will have higher system gains and lower electrical-consumption ratios than the design point for the tandem mirror system if the inertial fusion energy gain /eta/Q > 8.8. For the ICF system to have a higher hydrogen production rate per unit fusion power than the tandem mirror system requires that /eta/Q > 17. These can be achieved utilizing realistic laser and pellet performances.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 0901204452, 4478

4412 (EPRI-AP—3678, pp 1.1-1.20) **Research and development opportunities.** Lipinsky, E.S.; Anson, D. (Battelle Columbus Laboratories, OH). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The participants in the EPRI/TVA Workshop on Biomass suggested more than 30 research and development opportunity topics during the conference that was held in Palo Alto. A questionnaire pertaining to these topics was developed after the conference and mailed to conference attendees and to a few representative utilities that were known to be interested in biomass but who were unable to attend the workshop. A discussion of the top ranked research and development opportunities is presented.

4413 (EPRI-AP—3678, pp 18.1-18.6) **PG and E's experience with biomass projects.** Blanchet, M.J. (Pacific Gas and Electric Co., San Francisco, CA). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

In response to the need to develop reliable, economic, and clean fuel supplies, PG and E undertook a number of studies in partnership with Southern California Gas Company, the US EPA, the Gas Research Institute, and the US Department of Energy. They included feasibility studies of recovery of clean gas from animal manures, municipal solid wastes, and crop residues, and pilot and/or demonstration projects. PG and E's goals for biomass as an energy resource include demonstrating technical and economic feasibility, and generating consistent data for the design and construction of commercial projects. In the case of landfill gas recovery, involvement in the biomass projects is likely to culminate in the construction of commercial projects.

4414 (EPRI-AP—3678, pp 19.1-19.8) **Southern California Edison Company biomass utilization plans and experience.** Larson, L.E. (Southern California Edison Co., Rosemead). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Southern California Edison Company (SCE) has established an energy recovery from waste and biomass program to develop clean, reliable and economic fuel supplies. Research has concentrated on the gasification of municipal solid wastes and wood wastes. SCE is currently involved in the implementation of a waste-to-energy project in Ventura County where MSW and sewage will be converted to methane gas and electricity. A wood waste gasification demonstration is underway in Riverside County to evaluate the use of wood-derived gas in a utility boiler. SCE's research efforts are directed at developing alternate and renewable energy sources for the generation of electricity.

4415 (EPRI-AP—3678, pp 9.1-9.10) **Methane from biomass and wastes: the GRI program.** Isaacson, R.; Wilkey, M. (Gas Research Inst., Chicago, IL). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The Gas Research Institute is developing additional sources of supply for methane, a clean-burning gaseous fuel with desirable combustion properties. Biomass is a significant resource for production of methane in selected geographical areas. The GRI Program on Methane from Biomass and Wastes includes both terrestrial and aquatic energy crops, in addition to such organic wastes as municipal solid waste. Advanced conversion technology is also an important feature of GRI's program. The Comprehensive Regional Biomass Programs in Florida, the Northeast, and Texas are pioneering approaches to the development of integrated biomass energy systems. The objectives and some of the accomplishments of GRI's program are described.

4416 (EPRI-AP—3678, pp 11.1-11.12) **Locally owned utility perspective on biomass and biotechnology.** Leber, R.E. (American Public Power Association, Washington, DC). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Biomass and biotechnology are discussed in the context of the diverse services provided by the Nation's publicly owned local utilities. Municipal utilities, for example, are frequently required to provide for the disposal of solid and liquid wastes, supply gaseous fuels, and furnish fresh water, as well as generate electricity. Each of these functions could have biological overtones. These same local utilities, moreover, often have ready access to significant quantities of biomaterials (waste substances or process by-products) that could serve as substantial resources, when incorporated as feedstocks in one or more of these operations. After a brief overview of public power utilities and the scope of their services, examples of their current efforts relating to biomass or biological systems will be presented. There is a slow but steady movement in the industry toward the efficient integration of biomaterials and biological systems into utility planning programs. The developing fields of biotechnology (including the manipulation of genetic material) and biosynthesis have important implications for energy and the environment. A cross-section of recent work is summarized with emphasis on the interests and resources of the utility industry. Conclusions and recommendations focus on the considerable need for a broad range of scientific research, development, and demonstration in biosystems leading to commercial-scale applications in the utility industry.

4417 (EPRI-AP—3678, pp 20.1-20.6) **Electricity generation using biomass at Florida Power Corporation.** Rodriguez, L. (Florida Power Corp., St. Petersburg). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Florida Power Corporation is actively investigating the use of biomass-derived gas to replace the more conventional fuels for which the plants were designed. Two large scale experiments are described, the first one being designed to gasify waste wood and supply the gas to a boiler, the second one using methane generated by fermentation to supply a reciprocating engine. Wood wastes are gasified in a commercial updraft gasifier which totals about 3.2 tons/hr of wastes and produces 110 Btu gas at a rate equivalent to 160 gallons of fuel oil per hour. The fuel source for methane generation is a cattle feedlot, and as well as supplying the gas engine, the methane is used to raise process steam, while solid residues from the fermentation tanks are also utilized.

4418 (PB—84-235779) **Landfill gas production from large landfill simulators. Final report.** Jones, L.W.; Larson, R.J.; Malone, P.G. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Environmental Lab.). Aug 1984. 101p. NTIS, PC A06/MF A01.

Two sizes of landfill simulators or test cells; one set containing approximately 320 kg wet weight of municipal solid wastes (MSW) and the other set containing 2555 kg wet weight of MSW were used to measure the amount and composition of gases produced from MSW under typical landfill conditions. The relative amounts and gas compositions follow those reported by other investigators. This study demonstrates that the conditions present in the average MSW landfill are not ideal for maximum production of methane; but large quantities of methane can, nevertheless, be produced over the active decomposition period of landfilled MSW. Further studies on the effects of environmental and microbial nutritional factors on methane production in landfilled MSW are recommended.

4419 **(PB—84-237775) Biogasification of wood. Final report 1 July 1982-28 April 1983.** Jerger, D.E.; Razik, A.; Chynoweth, D.P. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1984. 75p. NTIS, PC A04/MF A01.

Work conducted recently at IGT under the GRI Land Biomass Program has demonstrated that significant conversion of different hardwood species can be accomplished without pretreatment other than particle size reduction. The objective of this study was to document the previously observed anaerobic biomethanogenic fermentation of wood using detailed physical and chemical analyses during the course of decomposition. IGT used enrichment techniques to develop a microbial inoculum that can convert woody biomass to methane without pretreatment. Methane yields of 5 to 6 SCF/lb of wood added have been achieved for several hardwoods which relates to a conversion of approximately 80% of the structural carbohydrates found in wood. These results were confirmed in this study using 3-L batch reactors fed hybrid poplar. Effluent analyses monitored during the digestion period indicated that the fermentation was stable. Organic analysis showed a 75% reduction in the cellulose fraction of poplar following the digestion period. These data refute currently accepted theory that wood is refractory to anaerobic digestion and suggest that biogasification is technically feasible and needs further documentation and study.

4420 **Molecular ingredients of heterogeneous catalysis.** Somorjai, G.A.; Yeates, R.C. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California). *Journal of the Electrochemical Society;* **131**: No. 7, 228C-233C(Jul 1984).

The purpose of this paper is to present a review and status report of the rapidly developing surface science of heterogeneous catalysis. The authors describe the experimental results that identified three molecular ingredients of catalysis: structure, carbonaceous deposit, and the oxidation state of surface atoms. The hydrogenation of ethylene at both the gas-solid and liquid-solid interfaces is described.

4421 **Excess molar enthalpies of $(xCO_2 + (1-x)C_2H_6)$ from 293.15 to 323.15 K at 7.58 MPa.** Pando, C.; Renuncio, J.A.R.; Izatt, R.M.; Christensen, J.J. (Brigham Young Univ., Provo, UT). *Journal of Chemical Thermodynamics;* **15**: 231-235(1983).

The excess molar enthalpies H/sub m//sup E/ for $(xCO_2 + (1-x)C_2H_6)$ were measured from 293.15 to 323.15 K at 7.58 MPa by means of an isothermal flow calorimeter. Although all mixtures show endothermic mixing, values of H/sub m//sup E/ for the mixtures at 293.15 K are more positive than those obtained at higher temperatures. The significance of the changes observed in the H/sub m/sup E/ with temperature is discussed in terms of the critical constants of $(xCO_2 + (1-x)C_2H_6)$. 12 references, 1 figure, 3 tables.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 0902004288, 4430, 4877

4422 (EPRI-AP—3678, pp 3.1-3.11) **Perspectives on use of biomass.** Lipinsky, E.S. (Battelle Columbus Laboratories, OH). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Electric utilities face increasing challenges in serving their customers because of the high level of uncertainty in many fuel supply systems. Only coal appears to have assumed stability and predictability. Long term reliance on petroleum and natural gas is questionable, and proposals to use nuclear resources for substantial percentages of fuel supply have led to high levels of uncertainty that arise from political, institutional, and environmental considerations. Therefore, those who plan additions or replacements in capacity are alert to alternatives to conventional fuel supplies. Biomass is one such alternative, and one which is sociologically attractive. Some perspectives on the use of biomass for electric power generation are presented so that workshop participants will have common ground for discussion and will be provided with enough challenges to stimulate fruitful discussions.

4423 (EPRI-AP—3678, pp 10.1-10.17) **Research at SERI relevant to the conversion of biomass-to-electricity.** Milne, T.A. (Solar Energy Research Inst., Golden, CO). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The Fuels and Chemicals Research Division of the Solar Energy Research Institute, as part of its broad research program on biomass conversion, has a significant involvement in biomass-to-electricity processes. Much of this work involves methanol. One major activity is the development of a fixed-bed, downdraft, high pressure, oxygen gasifier that produces a very clean synthesis gas suitable for methanol synthesis with a minimum of downstream processing. The combustion properties of biomass and the gasifier design make plausible commercial plants two orders of magnitude smaller than projected coal plants. A second major activity addresses the enhanced efficiency of utilization of biomass-produced methanol in internal combustion engines and turbines. The theoretical advantages of using waste heat in the system to dissociate the methanol to CO and H_2 before combustion are being realized in an experimental program involving cars and stationary turbines. A third major area of utilization research involves direct and indirect oxidation of methanol and ethanol in fuel cells. In the direct fuel cell work, novel electrodes and electrolytes will be tested in basic electrochemical studies. In more applied work, the coupling of alcohol dissociation, H_2 separation, and alkaline fuel cells is being assessed and bench tested.

4424 (EPRI-AP—3678, pp 5.1-5.11) **TVA's biomass fuels program.** Stinson, J.M. (National Fertilizer Development Center, Muscle Shoals, AL). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

In 1980 the Tennessee Valley Authority (TVA) created a Biomass Fuels Program to develop information and processes for effective use of Valley biomass (principally wood) by industry. Existing unused hardwood could relieve the Valley's dependence on oil and natural gas. Conversion of hardwoods to ethanol by acid hydrolysis is a primary objective of the program. About 30 years ago, TVA and the Forest Products Laboratory of the US Department of Agriculture carried out a joint study that resulted in an improved acid hydrolysis process for converting wood to sugar solutions; the sugars could then be converted to ethanol. This process could not be used economically in this country at that time, but the information was utilized in the USSR. Currently they have on the order of 40 plants for converting wood to ethanol and yeast. Study is underway on improvements which would decrease cost of production and improve process efficiency to the point where the production of ethanol from wood may be economical in this country. An associated activity involves development of Valley wood resource information and study of improved wood harvesting techniques. The valley also has a large amount of unused marginal land. Study is underway on production of ethanol from crops that could be grown on this marginal land and from agricultural wastes. Assistance is provided to the Department of Energy in monitoring of their loan guarantee program and to the Agency for international development in the development of programs for under-developed countries to utilize their available bioenergy sources effectively.

4425 **Thermodynamics of solution of naphthalene in various water-ethanol mixtures.** Bennett, D.; Canady, W.J. (West Virginia Univ. Medical Center, Morgantown). *Journal of the American Chemical Society;* **106**: No. 4, 910-915(22 Feb 1984). Contract AM21-77MC08087.

The temperature dependences of the solubilities of naphthalene in water and in various water-ethanol mixtures up to 0.07 mol fraction of ethanol have been determined. In the concentration range studied, a plot of the free energy of solution of naphthalene vs. mole fraction of ethanol present in the solvent is linear. The heat of solution of naphthalene in water is positive and becomes

more positive as the ethanol concentration is increased. This heat term is more than overcome by a concomitant large increase in the entropy of solution, the net effect being to solubilize the hydrocarbon by the addition of ethanol. The addition of ethanol to the aqueous phase is much more effective in solubilizing naphthalene at high rather than low temperatures. The results may be interpreted in terms of the McMillian-Mayer second virial coefficient. It is suggested that ethanol may exert its influence upon hydrocarbon solubility by loss of water structure as hydrophobic interactions take place between the hydrocarbon and alcohol. Dispersal of an iceberg or clathrate structure probably makes a significant contribution.

4426 **Fluidized-bed bioreactors using a flocculating strain of Zymomonas mobilis for ethanol production.** Scott, C.D. (Oak Ridge National Lab., TN). *Annals of the New York Academy of Sciences;* 448-456([1984]). Contract W-7405-ENG-26.

A recently isolated strain of Zymomonas mobilis (NRRL B-12526) has been shown to form stable floc particles that can effectively convert glucose to ethanol at rates in excess of 400 g/l/hr in a fluidized-bed bioreactor. Preliminary results indicate that such a system, yielding particles which are in the size range of 0.5 to 1mm, may have extremely high productivity, even higher than Saccharomyces cerevisiae. However, the system is so reactive that the CO_2 off-gas makes it difficult to maintain a high biomass loading in the upper part of the reactor. This lower biomass content results in a decreased ethanol productivity, which approaches 100 g/l/hr for the entire active reactor volume when over 95% of the glucose is metabolized.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 0904004422, 4448, 4452, 4807, 5529

4427 **(DOE/OR/21389—4) Northeast Regional Biomass Program. Quarterly report, April 1-June 30, 1984.** (CONEG Policy Research Center, Inc., Washington, DC (USA)). 1984. Contract FG05-83OR21389. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85000798.

This quarterly report covers the period from April 1, 1984 to June 30, 1984 for the Northeast Regional Biomass Program. During the period, the last of the 11 state grants under the program (with the Commonwealth of Pennsylvania) was signed. Work has continued in each state and in each subcontracted project. At the state level, assistance to businesses who could profit from the use of wood energy has continued. Several states have provided preliminary economic feasibility analyses for firms and nearly all have provided assistance in the form of one-to-one discussions and advice. Working in conjunction with a subcontractor, states assisted in staging two major industrial wood energy conferences during the quarter. Smaller workshops were held in three instances and numerous workshops are in the planning stages. In several states, significant progress has been made in assessing the extent of the biomass energy resource and current levels of its use. Subcontractors have continued to make progress toward providing reliable economic and technical information to businesses, state officials, and individuals. In addition to the impetus provided by subcontractors for the state-based conferences and workshops, subcontractors have produced a guidebook for industrial conversions and completed drafts of reports on residential emissions from woodburning, industrial stack emissions, and wood/coal co-firing opportunities. Work is also underway to draft a report on the state of the residential and small industrial market for wood chips. The long-range planning process is also well underway. A third meeting of the planning task forces was held during the quarter and draft reports are being prepared.

4428 (EPRI-AP—3678, pp 4.1-4.9) **EPRI projects in biomass and electric power generation from biomass.** Kohan, S.M. (Electric Power Research Inst., Palo Alto, CA). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

EPRI's R and D activities in biomass are discussed. The reasons for the conduct of this R and D are briefly reviewed, followed by a description of prior and current biomass activities. Synopses of research results are presented, and coordination of EPRI's biomass R and D activities with those of other organizations is discussed.

4429 (EPRI-AP—3678, pp 6.1-6.16) **Bonneville Power Administration biomass energy technology development program.** Seely, D.B. (Bonneville Power Administration, Portland, OR). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The Bonneville Power Administration (BPA) has oversight and management responsibility for the Department of Energy's Pacific Northwest and Alaska Bioenergy Program (PNWA Bioenergy Program). The program objectives are described and an outline of the projects and initiatives which are current or are envisioned in the states of Oregon, Washington, Idaho, Montana, and Alaska is given. In addition, information is included on the Notices of Program Interest issued by BPA, projects funded through the states under the PNWA Bioenergy Program, projects receiving direct federal support, and projects supported by the US Forest Service (USFS).

4430 (EPRI-AP—3678, pp 7.1-7.7) **Future directions of the Department of Energy's biomass energy research.** Berger, B. (Dept. of Energy, Washington, DC). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

DOE's Biomass Energy Technology Division (BET) will shortly complete the transition from near-term activities to long-term research. The current goal of the program is to provide the research base from which industry can develop the potential of biomass production and conversion technologies. Technology development, demonstration, and commercialization are areas where the private sector is best suited to assume responsibility. Significant progress has been made in feedstock production technologies (aquatic species, short rotation woody crops) and conversion technologies (thermochemical conversion, anaerobic digestion, biological hydrogen production). However, additional research is necessary before these technologies will fulfill their potential. The Fiscal Year 1983 Biomass Energy Technology Division program stresses basic research on a number of production and conversion technologies.

4431 (EPRI-AP—3678, pp 8.1-8.8) **Accomplishments and plans of the US Forest Service with respect to the production and utilization of forestry: derived raw materials for the generation of electric power.** Hornick, J. (Dept. of Energy, Washington, DC). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The demand for wood as an energy source has increased rapidly over the past 10 years with this trend expected to continue as long as wood competes favorably with other sources of energy. The US has an excess of annual growth over removals that is not readily available for commercial purposes. Recovery of this excess can be beneficial to the forest and the environment. Considerable research has already been completed that directly applies to this increased use of wood. However, this increased wood demand has generated the need for more precise data on timber supply, demand, and removals; the effect on forest productivity of removing greater quantities of the green biomass; and the need for more efficient harvesting, processing, and transportation to help keep the cost of this raw material competitive with other energy sources.

4432 (EPRI-AP—3678, pp 12.1-12.10) **R and D needs associated with the use of biomass for the generation of electric power.** Dolan, L.S. (Seattle City Light, WA). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

From 1978 to the present, Seattle City Light, municipal utility for the City of Seattle, has managed a US Department of Energy biomass plantation research. The research supports a Seattle City Council mandate to assess renewable resource options suitable for meeting future generation requirements. Research focuses on the potential for growing native forest species to produce biomass fuel. The fuel will be used to supply a 25-MW powerplant that requires 150,000 oven dry tons of fuel per year. Possible benefits of this approach are: (1) renewability of supply from coppicing of biomass plantations, (2) assurance of supply for the fuel user, and (3) projections of higher biomass yields through intensive silviculture. For the past four years, Seattle City Light has operated two biomass plantations and conducted studies on productivity and yield, fuel characteristics, biotic risks to biomass crops, and harvesting equipment requirements. Productivity has been significantly higher on the wet lowland site than on the dry upland site. Red alder has outproduced black cottonwood on both sites. The highest biomass production has resulted when trees are fertilized and spaced at 1.2 x 1.2 m. Using conventional harvesting equipment, recovery costs ranged from $56.80/OD ton to $75.15/OD ton. An economic assessment concluded that, under certain scenarios, biomass fuel can be cost competitive with fuel oil, natural gas and coal in the Pacific Northwest region.

4433 (EPRI-AP—3678, pp 13.1-13.13) **Direct comparison of truck and rail transportation of biomass.** Carr, T.R. (Burlington Electric Dept., VT). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Two methods of biomass transportation from a central collecting point to Burlington Electric's 50 MWe generating station are compared. Three quarters of all fuel will be transported by rail. Bottom-dump railcars will be loaded at a privately operated satellite yard. Unit train service will be on a six day per week basis. One-way haul distance from yard to plant is thirty-five (35) miles. Unloading will be accomplished on an elevated trestle. Fuel will free-fall from the railcars to grade and be removed to storage by front-end loaders. Fuel delivered to the plant by truck will come directly from the chipping site. A hydraulic truck dumper will be used to empty the trucks. Although some benefit will be realized by the establishment of a satellite yard because of an expanded fuel procurement zone, it is anticipated that the cost of fuel delivered by rail will be higher than the cost of fuel delivered by truck.

4434 (EPRI-AP—3678, pp 14.1-14.11) **Wood burning for power generation.** Rinard, K.W. (Eugene Water and Electric Board, OR). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Eugene Water and Electric Board has operated wood fired steam boilers for power generation since 1941. Two types of units that were built for this purpose, together with the wood handling and storage facilities are described. Information is given on emissions, performance, fuel characteristics, and costs. Present uncertainties in the supply and cost of wood wastes render uneconomic use for power generation in an area where thermal generation is competing with hydroelectric resources.

4435 (EPRI-AP—3678, pp 15.1-15.11) **Design and operating experience with the supplemental firing of sunflower hulls in a lignite utility boiler.** Bush, C.T. Jr. (Basin Electric Power Cooperative, Bismarck, ND). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

Basin Electric Power Cooperative has recently completed the retrofit to an existing pulverized lignite power plant of a sunflower seed hull combustion system. The station is located adjacent to a new sunflower seed processing plant in an area of intensive sunflower production. The project included research and engineering to allow the station to burn sunflower seed hulls at a rate of 240 tons per day and to supply to the processing plant 50,000 lbs/hr of 150 psig process steam. Sunflower seed hull combustion tests were conducted at the station and at the Department of Energy facilities in Grand Forks, North Dakota. These tests gave favorable results with regard to combustion, slagging fouling, and precipitator performance. Construction was begun in 1981 with the project declared commercial in June 1982. Key aspects of the project included the selection and retrofitting of the closed loop gravity conveying system and the material selection and design to minimize erosion by the sunflower hulls. Start-up has been completed and system refinement is proceeding satisfactorily. The station is consistently burning a blend of 70% lignite and 30% sunflower seed hulls without difficulty.

4436 (EPRI-AP—3678, pp 17.1-17.6) **Reflections on biomass.** Freeman, S.D. (Tennessee Valley Authority, Knoxville). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The benefits of increased use of biomass for power generation are discussed. The most obvious benefit is the potential for direct savings on fuel. The need for increased funding for research in the following areas is emphasized: municipal solid waste technology improvements; commercialization of ethanol from wood as a liquid fuel with great potential as a feedstock for fuel cells; collection of more detailed data on forest resource availability; and more research on the environmental impacts of selective tree harvesting and of cultivation of bioenergy crops on marginal lands.

4437 (EPRI-AP—3678, pp 21.1-21.8) **Biomass experience at the Washington Water Power Company: the Kettle Falls project.** Henriques, R.E. (Washington Water Power Co., Spokane). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The Washington Water Power Company is constructing a 49.5 MWe wood-fired steam turbine power plant at Kettle Falls, Washington. The background, technical economic considerations, and licensing procedures leading to the project, and the major features of the plant design are described. Fuel will consist of lumber mill wastes drawn from nine plants. The handling, storage, and feeding of the fuel present the more difficult problems, and these, together with control of particulate emissions, are dealt with in some detail. Information on the entire plant, including fuel and construction costs, is also provided.

0906 Gaseous Waste Fuels

4438 (EPRI-AP—3678, pp 16.1-16.12) **Experience in gasification of corn cobs and R and D plans at Coon Rapids, Iowa.** Smith, E.P. (Coon Rapids Municipal Utilities, IA). Sep 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920041. (CONF-8303174—).

From EPRI/TVA workshop on the use of biomass for the generation of electric power; Palo Alto, CA, USA (2 Mar 1983).

The corn growing states produce large quantities of combustible biomass in the form of corn cobs and corn stover. Corn cobs are readily available from seed corn producers, and with some modification to harvesting methods also could be available from field crops. In six corn growing states there are over 300 small utilities with diesel engine generating capacity. Information is presented on the technical and economic feasibilities of using corn cobs to generate producer gas to power diesel engines. Included is a brief account of a small scale demonstration project which suggests that

available simple technology could be applied successfully to utilize available diesel capacity for middle and peak load purposes.

13 HYDRO ENERGY

1301 Resources And Availability

4439 **(BHRA—84/41) Sediment exclusion at intakes, a review.** Avery, P. (British Hydromechanics Research Association, Cranfield). Aug 1981. 113p. (RR—1725). NTIS, PC $37.50.

A total of ninety-two papers, reports and books on the subject of sedimentation at intakes were selected and reviewed. The aim of the review was to collate the research in this field and the methods which have been used to solve the problems associated with sediment ingress at intakes, so that the range of options and some guidance would be made available to the designer. The report outlines the main areas of concern, the most common methods used to exclude or eject sediment from water system intakes, and includes conclusions, recommendations and a section on the use and techniques of model studies.

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 1306004439

1307 Power Conversion Systems

REFER ALSO TO CITATION(S) 1307004761

14 SOLAR ENERGY

REFER ALSO TO CITATION(S) 1400004810

1401 Resources And Availability

REFER ALSO TO CITATION(S) 1401004841

4440 **(DOE/CS/30634—4) Passive solar processes. Final progress report, August 1, 1981-August 31, 1984.** (Wisconsin Univ., Madison (USA). Solar Energy Lab.). Nov 1984. Contract FG02-81CS30634. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002894.

Three main research areas were included: (1) meteorological statistics, (2) studies of thermal characteristics of buildings, and (3) research on passive water heating design. A brief description of each of these areas, and an outline of the major accomplishments in each of them, are included. In addition to work in the three main research areas, other related passive systems research has been carried out. These fall in two main categories, papers on hybrid systems and general. This work is summarized.

4441 **(IC—83/193) Study of the errors in the calculation of extraterrestrial radiation on horizontal surface (H_o) and recommended days for the calculation of H_o-bar.** Jain, P.C. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700053.

Errors in the calculation of H_o can arise due to error in the angle of declination (delta) and the error in the measured value of the solar constant. An error of about 0.25 deg. in delta can arise due to the solar disc size. Also, an error in the value of n, the day of the year, causes some error in delta. The effect of a small error in delta on the calculated values of H_o has been studied. Relative errors in H_o per degree of error in delta have been calculated for different values of delta and phi, and the results are presented. The effect of a small error in n on the value of H_o has also been studied. The relative error in H_o, in general, is found to increase in both cases with increase in the magnitude of latitude values, implying the use of better n-values for the calculation of H_o. Calculation for H_o-bar, the monthly average daily mean of H_o, for all the twelve months and latitudes from +60 deg. to -60 deg. for 5 deg. interval have been done and the values of n have been obtained which give H_o within an accuracy of +-0.5% of the actually obtained mean values of H_o.

4442 **(IC—83/213) Solar irradiation over Zambia.** Jain, P.C. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700054.

Angstroem-Page linear regression equation between global irradiation and sunshine duration is fitted for five Zambian locations for which the direct measured values of the global irradiation exist. Excellent correlation is found to exist for all the five places. The values of the correlation coefficients for Lusaka, Livingstone, Ndola, Mansa and Mongu are found to be 0.99, 0.99, 0.98, 0.97 and 0.95, respectively, and the values of the regression coefficients (a,b) are (0.191, 0.534), (0.177, 0.638), (0.253, 0.434), (0.270, 0.483) and (0.235, 0.506), respectively. The regression coefficients are observed to vary with the elevation of the station above sea level. A linear relationship between the elevation and the coefficient a and a quadratic relationship between the elevation and the coefficient b is assumed and is used to estimate the values of the regression coefficients for 14 other stations in the country. Using the estimated values of the coefficients and the measured values of the sunshine duration, estimates of the global irradiation have been made for these locations. No data for the diffuse irradiation is available. The estimates for diffuse irradiation have been made for all the 19 locations using the expression $Hsub(D)=H(0.754-0.654\ S/S_o)$ used by Lewis, Solar Energy, 31, no. 1, 125-128 (1983), for estimating diffuse irradiation in Zimbabwean locations.

4443 **(N—84-26131) Radiative cooling resource.** Martin, M.; Berdahl, P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1983. 8p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 39-46, N—84-26125 16-44.

Results of an experimental infrared sky emissivity measurement program were combined with a method for estimating thermal radiation from clouds to develop an algorithm for calculating the effective sky temperature based on commonly recorded meteorological parameters. This algorithm is used with hourly weather data from 193 Typical Meteorological Year sites in the continental United States to produce contour maps and histograms for the sky temperature depression, and related resource information.

1403 Economics

4444 **(SAND—83-8175) Cost Data Management System (CDMS). User's guide. CDMS Version 1.1.** Weingart, J.M. (Polydyne, Inc., Menlo Park, CA (USA)). Oct 1984. Contract AC04-76DR00789. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002954.

The Cost Data Management System (CDMS) is an interactive computer program for cost data archival and retrieval, cost engineering and analysis, cost comparison and project management. Some of its features are: user-friendly software, development of capital cost account structures, elements of work, cost data entry, editing, and retrieval, cost data compilation and manipulation, annotation of cost data, specification of plant performance, specification of recurring cost, and generation of cost reports. Instructions for using the program are given. (LEW)

4445 **(SAND—83-8176) Solar thermal central receiver Cost Data Management System (CDMS). Final report.** Weingart, J.M.; Bos, P.B. (Polydyne, Inc., Menlo Park, CA (USA)). Oct 1984. Contract AC04-76DR00789. 100p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85003196.

The Cost Data Management System (CDMS) is an interactive computer program for cost data archival and retrieval, cost engineering and analysis, cost comparison and project management. It was developed to provide a cost data management tool for the Solar Thermal Central Receiver program, but is not specific to any particular power generation technology. Capital cost accounting and direct and indirect cost are discussed briefly, including cost ac-

counts for solar thermal, photovoltaic, and wind systems. Then the solar thermal central receiver account structure is discussed, including recurring and non-recurring costs and cost categories. The CDMS is described briefly, including a functional summary and program commands. (LEW)

1404 Environmental, Legal, And Institutional Aspects

4446 **(DOE/CS/30467—T7) Concept paper for continuation of minority focus on solar energy.** (Nellum (A.L.) and Associates, Inc., Washington, DC (USA)). 5 Dec 1980. Contract AC01-80CS30467. 152p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001533.

The work reported relates to a conference to help achieve greater awareness on the part of minorities regarding the potential economic benefits of solar energy. Summarized are: the status of activities related to pre-conference goals and plans; personnel resources to be devoted to completing activities and accomplishing preconference goals; corporate support to be provided; and an assessment of project strengths and weaknesses. (LEW)

4447 **(UCLA—12/1464) Analysis of plant invasion into the Barstow 10 MWe pilot STPS.** Smith, S.D. (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). Jun 1984. Contract AC03-76SF00012. 47p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003562.

An analysis of the invading vegetation within the heliostat field of Solar One was conducted during 1983 and 1984. Vegetation analyses included floristic inventories and quantification of plant density, diversity, and aboveground biomass. An attempt was made to assess present and potential operational/safety problems associated with vegetation presence. The invading vegetation was floristically and structurally dissimilar from an adjacent open control site. The invading flora was composed of weedy annuals, whereas the open desert was characterized by native perennial forbs. Several trends emerged: (1) green biomass of ephemerals and newly germinated woody plants was highest in the control site in spring but in the heliostat field in the summer; (2) species diversity was highest in the heliostat field; (3) average plant size was greater in the heliostat field; and (4) plant development and phenology shifted in the heliostat field, resulting in delayed senescence of plants into the dry season relative to the control site. Heliostat stow position and washing influenced the spatial pattern of vegetation. The direct effects of shading and perhaps water addition influenced vegetation presence and structure to a greater degree than did clearing and surface disturbances. The presence of vegetation caused operational and/or safety problems on the site, as the heliostat field was manually cleared or treated with herbicides during each year of the study. The primary problem appears to be tumbleweed, Salsola iberica, which grew abundantly. This growth, which was greatest near the base of each heliostat, prevented access to control boxes and provided possible cover for poisonous snakes. 19 references, 7 figures, 8 tables.

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 1405004412, 4413, 4414, 4415, 4416, 4417, 4419, 4422, 4423, 4424, 4427, 4428, 4429, 4430, 4431, 4432, 4433, 4434, 4435, 4436, 4437, 4438, 4518, 4807, 4809, 4811, 5332, 5430

4448 **(AD-A—144959/4) Biomass energy self-sufficiency resource alternatives for a forested air force installation. Final report July 1981-January 1982.** Huff, W.J.; Bronson, L.; McConnell, W.V.; Steadman, P.E. (Ultrasystems, Inc., Fairfax, VA (USA)). May 1982. 38p. NTIS, PC A03/MF A01.

This study was sponsored by the U.S. Air Force to determine the options available that would provide a cost-effective, practicable means for energy management of the forested lands of Eglin Air Force Base. The options proposed are structured to provide the appropriate fuel wood quantities required to support basewide biomass energy systems. The study confirmed the feasibility of a biomass energy plantation supplying the required fuel wood to support the basewide biomass energy systems while, at the same time not conflicting with any of the operational missions of Eglin AFB. This conclusion is based on a comparative analysis of five possible energy plantation options and their associated yields with respect to species and optimal silvicultural practices. Three of the plantation options were eliminated for various reasons. One was considered as effective, and one was deemed as being superior. The superior option will provide enough timber, after the initial cycle has been completed, to maintain the merchantable timber at desired levels and to more than adequately supply the fuel wood requirements to insure that Eglin AFB is energy self-sufficient. This will enable the Air Force to have an installation that provides all of its electrical and thermal energy requirements through the utilization of the Biomass Energy Island concept.

4449 **(BMFT-FB-T—84-137) Development of the production technology of Cu_2S/CdS solar generators.** Schurich, B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01 . File Number DE84752276.

NUKEM has set up a pilot line for the production of Cu_2S/CdS-thin film solar cells. In continuation of the research work done by Prof. Bloss and his team at the Institut fuer Physikalische Elektronik of the University of Stuttgart, NUKEM has developed the technology for producing large area Cu_2S/CdS thin film solar cells on an industrial scale. Many solar cells and solar modules of different size have been produced and the feasibility of a commercial utilization of Cu_2S/CdS thin film solar cells has been demonstrated.

4450 **(DOE/CE/30784—1) Energy wood harvesting technology: a review-of-the-state of the art.** (Meridian Corp., Alexandria, VA (USA)). Nov 1984. Contract AC01-83CE30784. 105p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85003095.

This report summarizes information obtained from the literature to provide a review of recent developments and evolving concepts in the technology of harvesting wood for use as an energy feedstock. Discussion centers on a variety of innovative prototype machines designed to recover or harvest above ground tree biomass from existing forests, as well as short-rotation intensively cultured plantations. Conventional forest harvesting equipment is addressed in a generic sense, and some broad economic considerations of energy wood harvesting and utilization are examined. Conventional forest harvesting equipment, methods and systems can often be modified or adapted to perform adequately in specific energy wood harvesting situations. There are, however, many other situations where conventional equipment may not be entirely adequate. Most conventional equipment is designed for use on fairly large and uniform stems. R & D efforts have been directed at improving wood harvesting technology in order to overcome some of the limitations. Efforts have resulted in the development of several innovative harvesting concepts and the construction of a number of prototype machines. These include: swathe cutters, residue recovery equipment, steep slope harvesters, and short-rotation harvesters. Results of analyzing the literature indicate that currently, the cost of producing energy chips, from stump to point of use, using modified conventional systems, can be expected to range from about $11 to 23/green ton (assuming road transport of approximately 20 miles). Harvesting costs alone account for at least half of the total cost. Transportation is also a significant factor; costs ranging from 11 to 28 cents/ton/mile limit the maximum economical trucking radius. The innovative prototype machines which have been constructed appear to be capable of producing energy wood at costs comparable to those of conventional systems.

4451 **(DOE/CS/84090—1) Assessment of increased biomass derived energy use in the southeastern United States. Phase I. Harvesting and collection. Final report.** Riall, B.W.; Brown, M.L.; Dusenberry, D.B.; Goode, M.C. (Georgia Inst. of Tech., Atlanta (USA). Economic Development Lab.). Aug 1984. Contract AS09-81CS84090. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002836.

The objective of this research was to complete the first phase of an investigation into the environmental impacts associated with increased use of biomass-derived energy. This phase included:

analyzing biomass technologies for applicability in the Southeast and then presenting the characteristics of those feasible; estimating the level of biomass utilization for three energy price scenarios; and analyzing the environmental impacts associated with the harvesting and collection of the biomass. The results indicate that there is potential for large amounts of biomass, particularly forestry biomass, to be available and used for the production of energy. The technologies identified as feasible in the near term are direct combustion or some form of pyrolysis/gasification. The types of the biomass most likely to be used are stickwood for home use or wood chips/pulverized wood for commercial/industrial use. Some small amount of anaerobic digestion for methane will also be present, but the absence of a preponderance of large feed lot operations diminishes its likely market penetration. Technologies not feasible for the Southeast include wood pelletization, methanol production from biomass, aquaculture, and catalytic liquefaction. The use of agricultural biomass for energy poses more serious potential negative impacts due to the much higher intensity use level of these lands. Countering this, however, is a smaller likelihood that the economics of energy usage would favor energy from this source in a way which would impose burdens on agricultural lands greater than already existing. It is even possible that the use of anaerobic digestion of manure could increase the use of digested sludge as a soil conditioner over what is now returned to the land.

4452 **(DOE/EFB—84/1) Energy from Biomass: a current-awareness bulletin.** Chertok, D.M. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). 15 Oct 1984. 19p. (PB—84-900601). NTIS, PC A02/MF A01; GPO Dep. File Number DE84016468.

Available on a subscription basis at $40.00 per volume (calendar) year as PB85-900600.

This bulletin contains references to journal articles, conference papers, reports, patents, books, and dissertations on all phases of biomass production, conversion, and utilization. This bibliographic information is obtained by searching the most current update of the DOE Energy Database and will be published semimonthly beginning in January, 1985. Topics covered include: biomass production (selection, growth, cultivation, and harvesting of terrestrial and aquatic plants for energy as well as the collection and availability of forest and agricultural wastes); biochemical and thermochemical conversion (including pretreatment, feasibility studies, and environmental aspects) of waste or biomass to produce alcohol and hydrocarbon fuels; solid waste and wood fuels (including municipal solid wastes, refuse-derived fuels, and wood charcoal); and biomass energy planning and policy.

4453 **(DOE/ER/10794—T1) Research on microemulsions for storage and conversion of solar energy. Final report.** Holt, S. (Oklahoma State Univ., Stillwater (USA). Engineering Energy Lab.). 1984. Contract FG02-80ER10794. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000181.

Our investigations focused on five areas of research: (1) the identification of norbornadiene/water/2-propanol and quadricyclane/water/2-propanol microemulsions; (2) the identification of a water continuous-oil dispersed microemulsion; (3) further characterization of the water/toluene/2-propanol water continuous microemulsion and the effects of surfactant upon the region boundaries; (4) the preparation and purification of the tetrasodium salt of tetra(p-sulfophenyl)porphinecobalt (II), CoTPPS; (5) the development of synthetic organic techniques which would allow altering the hydrophobic/hydrophilic balance of porphyrins, orthophenanthrolines and bipyridines in order to allow development of sensitizers for the norbornadiene → quadricyclane conversion or catalysts for the back reaction which may have their location varied throughout either phase of a microemulsion.

4454 **(DOE/ET/20074—T31) Eucalyptus plantations for energy production in Hawaii. Technical status report, October 1-31, 1984.** Schubert, T.H. (BioEnergy Development Corp., Hilo, HI (USA)). 9 Nov 1984. Contract FC03-78ET20074. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002697.

Highlights of progress accomplished during October, 1984 are summarized. BioEnergy Development Corp. has planted 290 hectares of Eucalyptus species on the island of Hawaii in a research and development project to demonstrate the feasibility of producing biomass energy from intensively-cultured, short-rotation plantations. Details are given about the management practices developed for nursery production, weed control, planting, spacing, species and provenances, fertilization, proposed harvesting systems, preliminary biomass estimates, and utilization of the product. Preliminary economic analyses indicate that on existing land, short-rotation eucalyptus plantations can have returns competitive with alternative uses.

4455 **(DOE/JPL/956797—02) Excimer laser annealing to fabricate low cost solar cells. Quarterly technical report No. 2, 1 July-30 September 1984.** (Spire Corp., Bedford, MA (USA)). Oct 1984. Contract NAS-7-100-956797. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002508.

The objective of this research is to determine whether or not pulsed excimer laser annealing (PELA) of ion-implanted junctions is a cost effective replacement for diffused junctions of crystalline silicon solar cells. The preliminary economic analysis completed during the first quarter of this program showed that the use of ion implantation and PELA to fabricate both the front junction and back surface field (BSF) would cost approximately 35 cents per peak watt (Wp), compared to a cost of 15 cents/Wp for a hypothetical baseline diffusion process that it is assumed to yield cells with an average efficiency of 14%. A cost advantage may be attained, however, if the implant-PELA process yields an improvement in the average cell efficiency from 14 to 16%; this improvement would lower the overall cost of the module by about 15 cents/Wp. The technical goal of this research is to develop an optimized PELA process compatible with commercial production, and to demonstrate increased cell efficiency with sufficient product for adequate statistical analysis. During the second quarter of this program, it was shown that the laser chosen for this work, operating with an output power of 50 watts, demonstrated sufficient processing speed for commercial production. Also during this time period, the PELA process was optimized for annealing phosphorus implants in polished p-type silicon wafers. The best solar cell obtained in this way had an efficiency of 10.5% at AM1 illumination without AR coating. This efficiency is equal to that of co-processed furnace annealed ion-implanted controls. Work planned during the next quarter includes optimization of the PELA process parameters for use with screen printed contacts, optimization of the PELA process for use with texture-etched material, and development of a set of parameters to anneal boron or boron-trifluoride implants.

4456 **(DOE/JPL/956828—2) Demonstration of feasibility of depositing semiconductor layers using microwave enhanced plasma techniques. Quarterly technical report, June 1-September 1, 1984.** (Superwave Tehnology, Inc., Santa Clara, CA (USA)). 1984. Contract NAS-7-100-956828. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000625.

The feasibility of low temperature deposition of dielectric films is demonstrated. The highlights of the June-August activity revolved around the deposition system integration, system test and some modifications. Furthermore, we were able to deposit a thin film of Si_3N_4 through the plasma reaction of nitrogen gas and SiH_4 at room temperature. Current activity on this project is centered around fine tuning of the system parameters such as gas flow control, partial pressure control, gas distribution in the reaction chamber and deposition rate.

4457 **(DOE/SF/11943—T1) Performance of solar thermal systems with liquid metal MHD conversion.** Pierson, E.S.; Jackson, W.D.; Berry, G.; Petrick, M.; Dennis, C. (HMJ Corp., Chevy Chase, MD (USA)). 15 Jun 1984. Contract AC03-83SF11943. 92p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85002758.

Liquid metal magnetohydrodynamic conversion (LMMHD) is found to be compatible with concentrating solar receivers employing a liquid metal as a heat transfer medium and offers significant increases in the system thermal efficiency over the 33% considered attainable with conventional turbo-machinery. There are two candidate liquid metals - sodium and lithium. With sodium at a

temperature of 1150°F (922°K), the maximum calculated efficiency is 39.5% while with lithium at 1400°F (1033°K) a peak efficiency for 46.5% is predicted. Up to two percentage points may be added by temperature increase and/or parameter limit relaxation in the sodium case. The sodium-steam heat exchanger is eliminated in liquid metal systems. Where LMMHD systems employ the same working fluid as the solar receiver, no recirculating pump is required as pumping power is provided directly by the cycle. For sodium, coupling with either a gas turbine or a steam turbine is beneficial and provides similar performance. With lithium, the gas turbine cycle is clearly superior. Sodium systems can be based on existing materials experience while the use of lithium will require an engineering development effort to establish suitable materials for containment. The existing sources of LMMHD data are generally sufficient for establishing a preliminary engineering basis for conceptual studies. An exception is the dc to ac power conditioning sub-system where further study is required. The design of concentrating solar receivers requires revisiting to accommodate the particular characteristics of the LMMHD system and its potential for operating at temperatures above those of conventional steam turboalternator systems.

4458 **(N—84-24656) Solar-array-materials passive LDEF experiment (A0171).** Whitaker, A.F.; Smith, C.F. Jr.; Young, L.E.; Brandhorst, H.W. Jr.; Forestieri, A.F.; Gaddy, E.M.; Bass, J.A.; Stella, P.M. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center; National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1984. 2p. NTIS, PC A09/MF A01.

In Langley Research Center, Long Duration Exposure Facility (LDEF), 86-87, N—84-24632 15-15.

The objective of this experiment is to evaluate the synergistic effects of the space environment on various solar-array materials, including solar cells, cover slips with various antireflectance coatings, adhesive, encapsulants, reflector materials, substrate strength materials, mast and harness materials, structural composites, and thermal control treatments. The experiment is passive and consists of an arrangement of material specimens mounted in a 3-in.-deep peripheral tray. The effects of the space environment on the specimens will be determined by comparison of preflight and postflight measurements of mechanical, electrical, and optical properties.

4459 **(N—84-24657) Advanced photovoltaic experiment (S0014).** Bradhorst, H.W. Jr.; Forestieri, A.F. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Feb 1984. 3p. NTIS, PC A09/MF A01.

In Langley Research Center, Long Duration Exposure Facility (LDEF), 88-90, N—84-24632 15-15.

The advanced photovoltaics-related experiments will investigate a portion of the solar spectrum and the effect of the space environment on photovoltaics. The information will be used to provide correlation between space and ground testing and also to provide for more accurate performance measurement in the laboratory. Specific objectives of these experiments are to provide information on the performance and endurance of advanced and conventional solar cells, to improve reference standards for photovoltaic measurements, and to measure the energy distribution in the extraterrestrial solar spectrum. Data to be obtained will include temperatures and short-circuit current of the samples. Six-point current-voltage (I-V) characteristics will be obtained for selected samples. These data will be recorded once a day during the flight. Orbit data will be correlated with preflight and postflight measurement of the samples.

4460 **(N—84-24658) Investigation of critical surface degradation effects on coatings and solar cells developed in Germany (S1002).** Preuss, L. (Messerschmitt-Boelkow-Blohm G.m.b.H., Muenchen (Germany, F.R.)). Feb 1984. 3p. NTIS, PC A09/MF A01.

In Langley Research Center, Long Duration Exposure Facility (LDEF), 91-93, N—84-24632 15-15.

Various coatings developed in the FRG (i.e., second-surface mirrors with interference filters with and without conductive layers, conductive layers on solar-cell covers, and selective absorber coatings) have been qualified by accelerated tests under simulated space environment conditions. Experiments with coatings and solar cells have shown, however, that the thermo-optical behavior can differ considerably when performed on the ground and in space because of the great difficulty in simulating the space environment realistically. The objective of this experiment is to qualify these coatings under realistic space environment conditions. In addition, the experiment will provide design criteria, techniques, and test methods to insure control of the combined space and spacecraft environment effects, such as contamination, electrical conductance, and optical degradation, on the coatings. Data to be measured include the temperature of the samples, the electrical resistance of the conductive layers of the samples, the short circuit current of the solar-cell modules, and the deposition of contaminants on the samples (using quartz crystal microbalances (QCM's)).

4461 **(N—84-25168) Basic and applied research related to the technology of space energy conversion systems, 1982-1983. Final report.** Hertzberg, A. (Washington Univ., Seattle (USA)). 1983. 12p. (NASA-CR—173554). NTIS, PC A02/MF A01.

Topics on solar energy conversion concepts and applications are discussed. An overview of the current status and future utilization of radiation receivers for electrical energy generation, liquid droplet radiation systems, and liquid droplet heat exchangers is presented.

4462 **(N—84-25172) Technical use of solar energy. Part 1. Thin films solar cells. Final report, February 1982.** Arndt, W.; Bauer, G.H.; Berger, H.U.; Bloss, W.H.; Hewig, G.H.; Pfisterer, F.; Schock, H.W. (Stuttgart Univ. (Germany, F.R.)). Dec 1983. 78p. (BMFT-FB-T—83-298-PT-1). NTIS, PC A05/MF A01.

Due to the potentialities of Cu2-xS-CdS thin film solar cells, several companies installed production lines for this type of solar cell. Besides investigations for further enhancing efficiency and long-term stability, for gaining data of physical and electronical parameters, and for improving the theoretical knowledge of the cell, materials and technologies are investigated which look promising for large-scale industrial production. Solar cells with an area of 42 sq cm are realized, showing efficiencies of up to 8% outdoor tests reveal that no system-inherent degradation mechanism exists when properly encapsulated cells are tested under realistic operation conditions. Large-area thin films of amorphous silicon with definite and reproducible properties are produced with two methods, both of which are well suited for the preparation: RF-sputtering in Ar/H2-mixtures and glow discharge in SiH4. Correlations exist between results of plasma diagnostics and analyses of the layers, allowing definite variations and an optimization of the production parameters. Various methods for the injection of different types of dopants into the plasma result in the implantation of electronically active dopants into the layers.

4463 **(N—84-27251) Evaluation of spatial, radiometric and spectral Thematic Mapper performance for coastal studies.** Klemas, V. (Delaware Univ., Newark (USA)). Jun 1984. 5p. (E—84-10159; NASA-CR—173671). NTIS, PC A02/MF A01.

The effect different wetland plant canopies have upon observed reflectance in Thematic Mapper bands is studied. The three major vegetation canopy types (broadleaf, gramineous and leafless) produce unique spectral responses for a similar quantity of live biomass. The spectral biomass estimate of a broadleaf canopy is most similar to the harvest biomass estimate when a broadleaf canopy radiance model is used. All major wetland vegetation species can be identified through TM imagery. Simple regression models are developed equating the vegetation index and the infrared index with biomass. The spectral radiance index largely agreed with harvest biomass estimates.

4464 **(N—84-28208) Safety-related requirements for photovoltaic modules and arrays. Final report.** Levins, A.; Smoot, A.; Wagner, R. (Underwriters Labs., Inc., New York (USA)). Mar 1984. 287p. (NASA-CR—173747; JPL—9950-908). NTIS, PC A13/MF A01.

Safety requirements for photovoltaic module and panel designs and configurations for residential, intermediate, and large scale applications are investigated. Concepts for safety systems, where each system is a collection of subsystems which together address the total anticipated hazard situation, are described. Descriptions of hardware, and system usefulness and viability are included. A comparison of these systems, as against the provisions of the 1984 National Electrical Code covering photovoltaic systems is made. A discussion of the Underwriters Laboratory UL investigation of the photovoltaic module evaluated to the provisions of the proposed UL standard for plat plate photovoltaic modules and panels is included. Grounding systems, their basis and nature, and the advantages and disadvantages of each are described. The meaning of frame grounding, circuit groundings, and the type of circuit ground are covered.

4465 **(N—84-28209) Investigation of test methods, material properties, and processes for solar cell encapsulants.** Willis, P.B. (Springborn Labs., Inc., Enfield, CT (USA)). 1983. 128p. (NASA-CR—173755; JPL—9950-901). NTIS, PC A07/MF A01.

A study of potentially useful low cost encapsulation materials for the Flat-Plate Solar Array project is discussed. The goal is to identify, evaluate, test and recommend encapsulant materials and processes for the production of cost-effective, long life solar cell modules. Technical investigations included studies of aging and degradation of candidate encapsulation materials, continued identification of primers for durable bonding of module interfaces, continued evaluation of soil resistant treatments for the sunlit surface of the module and testing of corrosion protective coatings for use low cost mild steel substrates.

4466 **(N—84-28210) Review of the silicon material task.** Lutwack, R. (Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1984. 45p. (NASA-CR—173743; JPL-PUBL—84-24). NTIS, PC A03/MF A01.

The Silicon Material Task of the Flat-Plate Solar Array Project was assigned the objective of developing the technology for low-cost processes for producing polysilicon suitable for terrestrial solar-cell applications. The Task program comprised sections for process developments for semiconductor-grade and solar-cell-grade products. To provide information for deciding upon process designs, extensive investigations of the effects of impurities on material properties and the performance of cells were conducted. The silane process of the Union Carbide Corporation was carried through several stages of technical and engineering development a pilot plant was the culmination of this effort. The work to establish silane fluidized-bed technology for a low-cost process is continuing. The advantages of the use of dichlorosilane is a siemens-type were shown by Hemlock Semiconductor Corporation. The development of other processes is described.

4467 **(N—84-28215) Microcrystalline silicon growth for heterojunction solar cells.** Iles, P.A.; Leung, D.C.; Fang, P.H. (Applied Solar Energy Corp., City of Industry, CA (USA)). 1984. 35p. (NASA-CR—173751; JPL—9950-886). NTIS, PC A03/MF A01.

A single source of evaporation with B mixed with highly doped Si is used instead of the coevaporation of separate Si and B sources to reduce possible carbon contamination. The results of both the heterojunction or heteroface structures, however, are similar when evaporation is used. The best Voc of the heterojunction is about 460mV and no improvement in Voc in the heteroface structure is observed. Slight Voc degradation occurred. A study of the p m-Si/p c-Si structure showed a negative Voc in many cases. The interface properties between the two materials are such that instead of repelling minority carriers from the substrate carrier, collection actually occurred. Another study of cells made in the part of substrates not covered by n-Si results in performance lower than the controls. This indicates possible substrate degradation in the process.

4468 **(N—84-28216) Microcrystalline silicon growth for heterojunction solar cells. Final report, November 1982-January 1984.** Leung, D.C.; Iles, P.A.; Fang, P.H. (Applied Solar Energy Corp., City of Industry, CA (USA)). Feb 1984. 42p. (NASA-CR—173750; JPL—9950-922). NTIS, PC A03/MF A01.

Microcrystalline Si (m-Si) films with a 1.7eV energy bandgap and crystal size of several hundred A were e-beam evaporated on single crystalline Si (c-Si) to form a heterojunction with the substrate, or a window layer to a single crystalline p-n junction (heteroface structure). The goal was to enhance Voc by such uses of the larger bandgap m-Si, with the intriguing prospect of forming heterostructures with exact lattice match on each layer. The heterojunction structure was affected by interface and shunting problems and the best Voc achieved was only 482mV, well below that of single crystal Si homojunctions. The heteroface structure showed promise for some of the samples with p m-Si/p-n structure (the complementary structure did not show any improvement). Although several runs with different deposition conditions were run, the results were inconsistent. Any Voc enhancement obtained was too small to compensate for the current loss due to the extra absorption and poor carrier transport properties of the m-Si film.

4469 **(N—84-28220) Summary of photovoltaic system performance models.** Smith, J.H.; Reiter, L.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1984. 105p. (NASA-CR—173737; JPL-PUBL—84-8). NTIS, PC A06/MF A01.

A detailed overview of photovoltaics (PV) performance modeling capabilities developed for analyzing PV system and component design and policy issues is provided. A set of 10 performance models are selected which span a representative range of capabilities from generalized first order calculations to highly specialized electrical network simulations. A set of performance modeling topics and characteristics is defined and used to examine some of the major issues associated with photovoltaic performance modeling. Each of the models is described in the context of these topics and characteristics to assess its purpose, approach, and level of detail. The issues are discussed in terms of the range of model capabilities available and summarized in tabular form for quick reference. The models are grouped into categories to illustrate their purposes and perspectives.

4470 **(N—84-28221) Carbon, oxygen and their interaction with intrinsic point defects in solar silicon ribbon material: a speculative approach.** Goesele, U.; Ast, D.G. (Cornell Univ., Ithaca, NY (USA)). Oct 1983. 60p. (NASA-CR—173756; JPL—9950-905). NTIS, PC A04/MF A01.

Some background information on intrinsic point defects is provided and on carbon and oxygen in silicon in so far as it may be relevant for the efficiency of solar cells fabricated from EFG ribbon material. The co-precipitation of carbon and oxygen and especially of carbon and silicon self interstitials are discussed. A simple model for the electrical activity of carbon-self-interstitial agglomerates is presented. The self-interstitial content of these agglomerates is assumed to determine their electrical activity and that both compressive stresses (high self-interstitial content) and tensile stresses (low self-interstitial content) give rise to electrical activity of the agglomerates. The self-interstitial content of these carbon-related agglomerates may be reduced by an appropriate high temperature treatment and enhanced by a supersaturation of self-interstitials generated during formation of the p-n junction of solar cells. Oxygen present in supersaturation in carbon-rich silicon may be induced to form SiO, precipitates by self-interstitials generated during phosphorus diffusion. It is proposed that the SiO2-Si interface of the precipates gives rise to a continuum of donor stables and that these interface states are responsible for at least part of the light inhancement effects observed in oxygen containing EFG silicon after phosphorus diffusion.

4471 **(N—84-28267) Environmental, health and safety assessment of photovoltaics.** Rose, E.C. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1983. 60p. (NASA-CR—173739; JPL-PUBL—83-88). NTIS, PC A04/MF A01.

The environmental, health, and safety (E, H and S) concerns associated with the fabrication, deployment, and decommissioning

of photovoltaic (PV) systems in terrestial applications are identified and assessed. Discussion is limited to crystalline silicon technologies. The primary E, H, and S concerns that arise during collector fabrication are associated with occupational exposure to materials of undetermined toxicity or to materials that are known to be hazardous, but for which process control technology may be inadequate. Stricter exposure standards are anticipated for some materials and may indicate a need for further control technology development. Minimizing electric shock hazards is a significant concern during system construction, operation and maintenance, and decommissioning.

4472 **(NP—5770017) Optimum adaptation of terrestrial solar generators to constant voltage systems with storage.** Wienhoefer, W. (Hannover Univ. (Germany, F.R.). Fakultaet fuer Maschinenwesen). 1 Feb 1983. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770017.

A multitude of photovoltaic supply systems featuring a storage battery contain - along with the battery charge controller - a direct-current converter which is always adjusted by a maximum-value controller in such a way that the solar generator will yield the maximum of capacity available instantaneously to the subsystems downstream. The corresponding alternative type of combination consists in a direct connection of the generator to the battery via a reverse-current protection diode without any constant-voltage converter. These two combination types are compared concerning their losses typical of the system involved during longterm operation. For this purpose, the statistical data of the generator outputs were established for a period of one year. A computer simulation was done and its basic approaches to the electric properties of constant voltage converters and special batteries were represented parametrically. An analytical function for the Si solar cells had to be set up for calculating losses owing to mismatch and was studied in greater detail.

4473 **(SAND—83-7040/1) Analysis of inverter models and harmonic propagation. Part I. A physical simulator for large solar cells arrays.** Slonim, M.A.; Stanek, E.K.; Imece, A. (Michigan Technological Univ., Houghton (USA). Dept. of Electrical Engineering). Sep 1984. Contract AC04-76DP00789. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002312.

Part I of a three part study presents the experimental and theoretical analysis of a physical simulator that simulates the output current-voltage characteristics of large solar cell arrays. The simulator system is composed of a separately excited dc generator and a microcomputer based controller. The desired output characteristics of the solar cell arrays are obtained at the dc generator terminals by the control of the generator exciting current. The microcomputer generates a controlled error signal based on the simultaneous solution of the dc generator load equation and the analytical expression of the experimentally obtained solar cell characteristic. This controlled error signal changes the exciting current of the dc generator such that the output characteristics of the solar cell arrays are obtained. Part II of the study (SAND83-7040/2) presents a detailed description of harmonic propagation, and Part III (SAND83-7040/3) presents an analysis of the transient and steady-state processes of inverter models.

4474 **(SERI/SP—271-2502) Photovoltaics reading list.** (Solar Energy Research Inst., Golden, CO (USA)). 1984. Contract AC02-83CH10093. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84013042.

The articles, conference papers, monographs and technical reports cited here are meant to provide a basic introduction to photovoltaics, its research, economics, and technology development. In addition to specific articles and books, several directories, bibliographies, journals, and magazines are suggested as additional sources of information.

4475 **(SERI/STR—211-2412) Material models and device structures for GaAs solar cells.** Maziar, C. (Purdue Univ., Lafayette, IN (USA). School of Electrical Engineering). Sep 1984. Contract AC02-83CH10093. 155p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000501.

GaAs as a solar cell material has received much attention because of its promise of high conversion efficiencies. Advantages of GaAs over Si as a photovoltaic material include: (1) a bandgap that is better matched to the solar spectrum, (2) superior performance at high operating temperatures, and (3) radiation resistance properties. Clearly, a computer program modeling the essential device physics is desirable for analysis and optimization of cell designs. Previous work in the School of Electrical Engineering at Purdue has demonstrated the utility of such a program. The work described in this thesis has been to extend the code developed at Purdue to analysis of GaAs cells. This work has been primarily directed at developing and assembling models for material parameters for GaAs relevant to photovoltaic applications, as well as identifying those material parameters and properties requiring further experimental and theoretical investigation.

4476 **(SERI/STR—211-2451) Research on the basic understanding of high efficiency in silicon solar cells. Annual report, 1 December 1982-30 November 1983.** Rohatgi, A.; Rai-Choudhury, P. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 125p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85000507.

This report presents results of research designed to develop a basic understanding of high-efficiency silicon solar cells and achieve cell efficiencies greater than 17% by employing innovative concepts of material preparation, cell design, and fabrication technology. The research program consisted of a theoretical effort to develop models for very high-efficiency cell designs, experimental verification of the designs, and improved understanding of efficiency-limiting mechanisms such as heavy doping effects and bulk and surface recombination. Research was performed on high-lifetime float-zone silicon, the baseline materials, low-resistivity gallium-doped czochralski silicon, and boron-doped float-zone silicon.

4477 **Limitations to the application of the electron-beam-induced current in hydrogen-passivated silicon grain boundaries.** Yacobi, B.G.; Matson, R.J.; Herrington, C.R.; Tsuo, Y.S. (Solar Energy Research Institute, Golden, Colorado 80401). *Journal of Applied Physics;* **56**: No. 10, 3011-3013(15 Nov 1984).

The electron-beam-induced current (EBIC) mode of a scanning electron microscope is used to investigate the effect of hydrogen passivation on silicon grain boundaries. A reduction in the grain boundary surface recombination velocity is observed by EBIC linescans after passivation. The EBIC signal decays with repeated linescans across hydrogen-passivated grain boundaries. This is probably associated with the electron-beam-induced breaking of passivated bonds in the grain boundary. Subsequent annealing at about 200 °C restores the hydrogen passivation effect on grain boundaries.

4478 **Status of biomass fuels technologies research in the US.** Koontz, R.P.; Parker, S.; Glenn, B. (Solar Energy Research Inst., Golden, Colorado). *International Journal of Solar Energy;* **2**: No. 5, 369-384(Jul 1984).

Biomass is a tremendous potential source of fuel and chemical feedstocks. The US Department of Energy has sponsored a broad spectrum of research on biomass at various US government laboratories, private installations, and universities. The status of biomass fuels technologies research in the US is discussed.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 1406004472, 4473, 4522

4479 **(N—84-25162) Qualification testing of solar photovoltaic powered refrigerator freezers for medical use in remote geographic locations. Final report.** Kaszeta, W.J. (Motorola, Inc., Phoenix, AZ (USA)). Dec 1982. 58p. (NASA-CR—168181). NTIS, PC A04/MF A01.

One of the primary obstacles to the application of vaccination in developing countries is the lack of refrigerated storage. Vaccines exposed to elevated temperatures suffer a permanent loss of

potency. Photovoltaic (PV) powered refrigerator/freezer (R/F) units could surmount the problem of refrigeration in remote areas where no reliable commercial power supply is available. The performance measurements of two different models of PV powered R/F units for medical use are presented. Qualification testing consisted of four major procedures: no-load pull down, ice making, steady-state (maintenance), and holdover. Both R/F units met the major World Health Organization (WHO) requirements. However, the testing performed does not provide complete characterization of the two units such information could be derived only from further extensive test procedures.

4480 **(N—84-25163) Solar photovoltaic powered refrigerators/freezers for medical use in remote geographic locations. Final report.** Darkazalli, G.; Hein, G.F. (Solar Power Corp., Woburn, MA (USA)). Oct 1983. 98p. (NASA-CR—168268). NTIS, PC A05/MF A01.

One of the obstacles preventing widespread immunication against disease is the virtual absence of reliable, low maintenance refrigeration systems for storage of vaccines in remote geographic locations. A system which consists of a solar photovoltaic cell array and an integrated refrigerator/freezer-energy storage unit is discussed herein. The array converts solar radiation into direct current (DC) electricity with no moving parts and no intermediate steps. A detailed description of the refrigeration system, its design and an analysis thereof, performance test procedures, and test results are presented. A system schematic is also provided.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 1407004445, 4518

4481 **(DOE/DR/00789—T6) SSPS-CRS first period of operation: preliminary operation results, experiences, and events. IEA Small Solar Power Systems Project SR4.** Bucher, W. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). May 1984. Contract AC04-76DR00789. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001463.

Some lessons learned from operating the SSPS-CRS plant for over one and a half years are presented and major results from the evaluation of plant performance data are provided. Meteorological conditions at the site during the period of operation are described, including insolation, wind, temperatures, precipitation, and a thunderstorm. The performance of the heliostat field system, receiver, sodium heat transfer system, and power conversion system is discussed, and results are given of heliostat flux measurements, receiver efficiencies and losses, sodium heat transfer system losses, heat transfer system performance and efficiency. (LEW)

4482 **(DOE/DR/00789—T7) SSPS monthly data: plant operation report and daily operation summary.** (Compania Sevillana de Electricidad, S.A., Madrid (Spain)). 1984. Contract AC04-76DR00789. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002514.

Daily operation data are given for both the central receiver and distributed collector systems for the month of June 1984. Data include meteorological data, heliostat field performance, power conversion, and electric energy production. (LEW)

4483 **(DOE/DR/00789—T8) SSPS monthly data: plant operation report and daily operation summary.** (Compania Sevillana de Electricidad, S.A., Madrid (Spain)). 1984. Contract AC04-76DR00789. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002512.

Daily operation data are given for both the central receiver and the distributed collector systems for the month of May 1984. Data include meteorological data, heliostat field performance, power conversion, and electric energy production. (LEW)

4484 **(DOE/DR/00789—T10) Thermal evaluation of the distributed collector systems of Almeria.** Sandgren, J. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 28 Feb 1984. Contract AC04-76DR00789. 99p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002513.

The report describes the evaluation work carried out on the distributed collector systems at the Almeria-plant in Spain. Based on measured data forwarded on magnetic tapes, an evaluation of the collector fields was performed and a prediction of similar fields' behaviors in Sweden. The indications are that it is of utmost importance to minimize parasitic loads if concentrating collector fields are to prove competitive in Swedish climate, but that they may be so in medium temperature applications.

4485 **(N—84-28218) Kinematic Stirling engine as an energy conversion subsystem for paraboloidal dish solar thermal plants.** Bowyer, J.M. (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1984. 72p. (NASA-CR—173724; JPL-PUB—84-30). NTIS, PC A04/MF A01.

The potential of a suitably designed and economically manufactured Stirling engine as the energy conversion subsystem of a paraboloidal dish-Stirling solar thermal power module was estimated. Results obtained by elementary cycle analyses were shown to match quite well the performance characteristics of an advanced kinematic Stirling engine, the United Stirling P-40, as established by current prototypes of the engine and by a more sophisticated analytic model of its advanced derivative. In addition to performance, brief consideration was given to other Stirling engine criteria such as durability, reliability, and serviceability. Production costs were not considered here.

4486 **(N—84-28224) Proceedings of the Fifth Parabolic Dish Solar Thermal Power Program.** Lucas, J.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 330p. (NASA-CR—173745; JPL—84-13). NTIS, PC A15/MF A01.

The proceedings of the Fifth Parabolic Dish Solar Thermal Power Program Annual Review are presented. The results of activities within the Parabolic Dish Technology and Module/Systems Development element of the Department of Energy's Solar Thermal Energy Systems Program were emphasized. Among the topics discussed were: overall Project and Program aspects, Stirling and Brayton module development, concentrator and engine/receiver development along with associated hardware and test results distributed systems operating experience international parabolic dish development activities and non-DOE-sponsored domestic dish activities. Solar electric generation was also addressed. For individual titles, see N84-28225 through N84-28258.

4487 **(N—84-28235) Advanced Solar Power Systems.** Atkinson, J.H.; Hobgood, J.M. (Advanced Solar Power, Inc., Anaheim, CA (USA)). Mar 1984. 13p. NTIS, PC A15/MF A01.

The Advanced Solar Power System (ASPS) concentrator uses a technically sophisticated design and extensive tooling to produce very efficient (80 to 90%) and versatile energy supply equipment which is inexpensive to manufacture and requires little maintenance. The advanced optical design has two 10th order, generalized aspheric surfaces in a Cassegrainian configuration which gives outstanding performance and is relatively insensitive to temperature changes and wind loading. Manufacturing tolerances also have been achieved. The key to the ASPS is the direct absorption of concentrated sunlight in the working fluid by radiative transfers in a black body cavity. The basic ASPS design concepts, efficiency, optical system, and tracking and focusing controls are described.

4488 **(N—84-28236) Solar thermal electric power capacity sizing.** Clark, J.S. (Deltatemp Energy Corp., Fort Wayne, IN (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The commercialization of parabolic dish/generator modules are investigated. Design analysis indicates that a 10 sq m/ three kilowatt generator configuration is simple and easy to maintain, manufacturing is easily adaptable, the demand is already established, the unit is cost effective and the hardware is readily available.

4489 **(N—84-28239) SPIKE-2: a practical Stirling engine for kilowatt level solar power.** Beale, W.T. (Sunpower, Inc., Athens, OH (USA)). Mar 1984. 4p. NTIS, PC A15/MF A01.

Recent advances in the art of free piston Stirling engine design make possible the production of 1-10kW free piston Stirling linear alternator engine, hermetically sealed, efficient, durable and simple in construction and operation. Power output is in the form of single or three phase 60 Hz. AC, or DC. The three phase capability is available from single machines without need of external conditioning. Engine voltage control regains set voltage within 5 cycles in response to any load change. The existing SPIKE-2 design has an engine alternator efficiency of 25% at 650 C heater wall temperature and a service life of over three years in solar service. The same system can be scaled over a range of at least 100 watts to 25kW.

4490 (N—84-28240) **Stirling module development overview.** Livingston, F.R. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 6p. NTIS, PC A15/MF A01.

The solar parabolic dish Stirling engine electrically generating module consists of a solar collector coupled to a Stirling engine powered electrical generator. The module is designed to convert solar power to electrical power in parallel with numerous identical units coupled to an electrical utility power grid. The power conversion assembly generates up to 25 kilowatts at 480 volts potential/3 phase/alternating current. Piston rings and seals with gas leakage have not occurred, however, operator failures resulted in two burnt out receivers, while material fatigue resulted in a broken piston rod between the piston rod seal and cap seal.

4491 (N—84-28241) **Parabolic dish Stirling module.** Washom, B. (Advanco Corp., El Segundo, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The design, manufacture, and assembly of a commercially designed parabolic dish Stirling 25 kWe module is examined. The cost, expected performance, design uniquenesses, and future commercial potential of this module, which is regarded as the most technically advanced in the parabolic dish industry is discussed.

4492 (N—84-28242) **United Stirling's solar engine development: the background for the Vanguard engine.** Holgersson, S. (United Stirling AB, Malmo (Sweden)). Mar 1984. 7p. NTIS, PC A15/MF A01.

The development and testing resulting in the Vanguard engine and some of the characteristics of the Stirling engine based power conversion unit are described. The major part of the solar engine development is concentrated to the three different areas, the receiver, the lubrication system and the control system. Five engines are on test within the solar project. The function of the components are validated in actual solar tests.

4493 (N—84-28243) **Testing of the United Stirling 4-95 solar Stirling engine on test bed concentrator.** Nelving, H.G. (United Stirling AB, Malmo (Sweden)). Mar 1984. 7p. NTIS, PC A15/MF A01.

The objectives with the testing, test set-ups, component designs, and the results of the testing of the solar Stirling engine in a parabolic dish system are presented. The most important tests are characterization of receivers, full day performance of complete system, cavity and aperture window test including influence from wind effects, control system tests, radiator system tests and special temperature measurements with infrared camera. The influence on performance of flux distribution depnding on concentrator alignment, and the optimum receiver operating criteria when balancing flux and temperatures on cooled receiver surface while avoiding flux on uncooled surfaces are also discussed.

4494 (N—84-28244) **Vanguard concentration.** Hagen, T. (Advanco Corp., El Segundo, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The design, manufacture, and performance of a solar parabolic dish/Stirling engine system are investigated. The commercialization of the system is discussed based on ease of fabrication, assembly, and cost effectiveness. The various components contributed from government and related industries are evaluated.

4495 (N—84-28246) **Near-term Brayton module status.** Davis, S.B. (Sanders Associates, Inc., Nashua, NH (USA)). Mar 1984. 9p. NTIS, PC A15/MF A01.

The integration of subsystem components and the testing of a Parabolic Dish Module (PDM) to convert solar energy to grid compatible electric power is examined. System components are selected on a basis of current and projected performance efficiencies, technology readiness, future production probabilities and prices, current cost and availability. Potential for a near-term, 8 kW derivative of the PDM is adjudged to be superior to that of a 20 kW system. The PDM is suited to both grid connected and standalone applications, and it may be fired by solar, fossil, or solar/fossil hydrid means.

4496 (N—84-28247) **Subatmospheric Brayton-cycle engine program review.** Johnson, R.L. (AiResearch Mfg. Co., Torrance, CA (USA)). Mar 1984. 5p. NTIS, PC A15/MF A01.

A solar energy powered electrical generator utilizing a Subatmospheric Brayton cycle engine is examined. The generator consists of a subatmospheric, Brayton-cycle engine and a permanent magnet (PM) alternator. The electrical power is generated by an alternator driven directly by the Brayton-cycle engine rotating group. Features that enhance reliability and performance include air foil bearings on both the Brayton-cycle engine rotating group and the PM alternator, an atmospheric-pressure solar receiver and gas-fired trim heater, and a high temperature recuperator. The subatmospheric Brayton-cycle engine design is based on that of the gas fired heat pump engine.

4497 (N—84-28248) **LEC system development.** Halbert, D.D. (Lajet Energy Co., Abilene, TX (USA)). Mar 1984. 2p. NTIS, PC A15/MF A01.

The Lajet Energy Company (LEC) 460 is described. A parabolic dish which incorporates a microprocessor to automatically point it toward the Sun from sunrise to sunset is used. The dish is composed of a set of mirrors (made of reflective polymeric film) which focus and concentrate the Sun's energy on a receiver, producing intense but controlled amounts of heat. The LEC 460 employs a design concept that permits the use of common and low cost materials. All major structural components are fabricated from low carbon, low alloy steel using methods adaptable to mass production. The mirrors are supported on a steel tubing frame. This frame is attached near its center of gravity to a cantilevered support structure. The mirrors and frame are counterbalanced by the weight of the receiver, thus reducing the energy needed to move the collector (parasitic load) and allowing movement on two axes. Each LEC 460 solar concentrator contains a reflective array consisting of twenty four 60 inch diameter mirrors.

4498 (N—84-28249) **Solar Total Energy Project (STEP) performance analysis of high temperature energy storage subsystem.** Moore, D.M. (Georgia Inst. of Tech., Atlanta (USA)). Mar 1984. 9p. NTIS, PC A15/MF A01.

The 1982 milestones and lessons learned performance in 1983 a typical day's operation of collector field performance and thermal losses and formal testing are highlighted. An initial test that involves characterizing the high temperature storage (hts) subsystem is emphasized. The primary element is on 11,000 gallon storage tank that provides energy to the steam generator during transient solar conditions or extends operating time. Overnight, thermal losses were analyzed. The length of time the system is operated at various levels of cogeneration using stored energy is reviewed.

4499 (N—84-28250) **White Cliffs: operating experience.** Kaneff, S. (Australian National Univ., Canberra). Mar 1984. 13p. NTIS, PC A15/MF A01.

The fourteen dish white cliffs solar power station area is remote and subject to extreme environmental conditions, solution of the associated problems required careful and thoughtful attention and the application of resources. Notwithstanding the wide range and harshness of conditions, the difficulties caused by remoteness and the lack of a technological base and the need for relatively rapid demonstration of success, the project has had a very positive outcome. Qualitative and quantitative information and lessons are now available to enable considerable simplifications to be made for a new system, reducing both hardware and operation and maintenance costs. Experience and lessons are presented, particularly in

relation to: system performance in various environmental conditions design philosophies for collectors, the array, control systems, engine and plant operation and maintenance strategies and cost reducing possibilities. Experience so far gives encouragement for the future of such paraboloidal dish systems in appropriate areas.

4500 **(N—84-28251) Operational experience from solar thermal energy projects.** Cameron, C.P. (Sandia National Labs., Albuquerque, NM (USA)). Mar 1984. 10p. NTIS, PC A15/MF A01.

Over the past few years, Sandia National Laboratories were involved in the design, construction, and operation of a number of DOE-sponsored solar thermal energy systems. Among the systems currently in operation are several industrial process heat projects and the Modular Industrial Solar Retrofit qualification test systems, all of which use parabolic troughs, and the Shenandoah Total Energy Project, which uses parabolic dishes. Operational experience has provided insight to both desirable and undesirable features of the designs of these systems. Features of these systems which are also relevant to the design of parabolic concentrator thermal electric systems are discussed. Other design features discussed are system control functions which were found to be especially convenient or effective, such as local concentrator controls, rainwash controls, and system response to changing isolation. Drive systems are also discussed with particular emphasis of the need for reliability and the usefulness of a manual drive capability.

4501 **(N—84-28253) Recent advances in design of low cost film concentrator and low pressure free piston Stirling engines for solar power.** Kleinwaechter, J.; Kleinwaechter, H.; Beale, W. (Bomin-Solar G.m.b.H., Loerrach (Germany, F.R.)). Mar 1984. 18p. NTIS, PC A15/MF A01.

The free piston Stirling-linear alternator was shown to be scalable to power levels of tens of kilowatts in a form which is simple, efficient, long lived and relatively inexpensive. It avoids entirely the vexing problem of high pressure shaft, and its control requirements are not severe nor do they represent a significant threat to durability. Linear alternators have demonstrated high efficiency and moderate weight, and are capable of delivering 3 phase power from single machines without great increases of cost or complexity. There remains no apparent impediments to the commercial exploitation of the free piston engine for solar electric power generation.

4502 **(N—84-28254) Base engine for solar Stirling power.** Meijer, R.J.; Godett, T.M. (Stirling Thermal Motors, Inc., Ann Arbor, MI (USA)). Mar 1984. 17p. NTIS, PC A15/MF A01.

A new concept in Stirling engine technology is embodied in the base engine now being developed at Stirling Thermal Motors, Inc. This is a versatile energy conversion unit suitable for many different applications and heat sources. The base engine, rated 40 kW at 2800 RPM, is a four-cylinder, double-acting variable displacement Stirling engine with pressurized crankcase and rotating shaft seal. Remote-heating technology is incorporated with a stacked-heat-exchanger configuration and a liquid metal heat pipe connected to a distinctly separate combustor or other heat source. High efficiency over a wide range of operating conditions, long life, low manufacturing cost and low material cost are specifically emphasized. The base engine, its design philosophy and approach, its projected performance, and some of its more attractive applications are described.

4503 **(SAND—82-8177-Vol.1) Molten salt steam generator subsystem research experiment. Phase 1, final report. Volume 1. Technical.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.; Babcock and Wilcox Co., Alliance, OH (USA). Contract Research Div.). Oct 1984. Contract AC04-76DR00789. 181p. NTIS, PC A09/MF A01. File Number DE85003020.

A study was completed in which steam generator subsystem and component designs were developed for central receiver solar power applications using molten nitrate salt as the primary heat transfer medium. Designs were established for a 100 MWe stand-alone plant and for a 100 MWe fossil-fueled plant which has been 50% repowered by solar energy. In the course of this program, (1) and optimum steam system arrangement was selected for both the stand-alone and repowering applications; (2) cost-effective heat exchanger designs (preheater, evaporator, superheater, and reheater) were established based on conventional fabrication processes; (3) comprehensive subsystem and component specifications were prepared; (4) a control system was designed and characterized, and the system response to selected upset transients was simulated; (5) shop fabrication and field erection plans, schedules, and cost estimates were developed; and (6) development plans intended to resolve design uncertainties and assure user confidence and acceptance were prepared.

4504 **(SAND—82-8177-Vol.2-App.) Molten salt steam generator subsystem research experiment. Phase I, final report. Volume 2. Appendices.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.; Babcock and Wilcox Co., Alliance, OH (USA). Contract Research Div.). Oct 1984. Contract AC04-76DR00789. 311p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85003021.

Information is given on: steam generator subsystem requirements specification, pressure boundary code calculations, structural analysis compliance check lists, supplemental elevated temperature rules, system simulation analysis, control system design, and a phase II proposal. (LEW)

4505 **(SAND—82-8178-Vol.1) Molten salt receiver subsystem research experiments. Phase 1, final report. Volume 1. Technical.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.). Oct 1984. Contract AC04-76DR00789. 342p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85002669.

This report presents the preliminary design of a molten salt receiver subsystem for application to solar thermal central receiver power plants. The design is applicable to a repowered utility electric plant or to a stand-alone plant. The receiver subsystem consists of an elevated quad-cavity receiver, a concrete tower to support the receiver, riser and downcomer piping within the tower to transport the salt to and from the thermal storage sub-system, heat adsorption panels within the receiver cavities to absorb the incident radiant energy, and the pumps, tanks, piping systems, valves, controls and instrumentation necessary to provide safe and efficient operation of the receiver subsystem. Incident energy is concentrated on the receiver cavity openings by a surround heliostat field. The design is based on a 320 MWt receiver sited at Barstow, California. The report provides the design requirements necessary to detail the design of the receiver subsystem, a detailed description of the subsystem components, and the design methods employed to produce the design. A development plan highlights the areas of technical uncertainty along with the required development effort to resolve these uncertainties. Manufacturing processes were developed to establish the fabricability of the heat absorption panels. The cost and schedule from design through start up for the receiver subsystem are also provided.

4506 **(SAND—82-8178-Vol.2) Molten salt receiver subsystem research experiments. Phase 1, final report. Volume 2. Appendices.** (Babcock and Wilcox Co., Barberton, OH (USA). Nuclear Equipment Div.). Oct 1984. Contract AC04-76DR00789. 454p. NTIS, PC A20. File Number DE85002668.

Information is given on: receiver subsystem requirements and specifications, elevated temperature analysis, control system design, skewed heating analysis, stress analysis of full length heat absorption tubes, and cavity efficiency. (LEW)

4507 **(SAND—84-8181) 10 MWe solar thermal central receiver pilot plant Mode 1 (Test 1110) test report.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Oct 1984. Contract AC04-76DR00789. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85003154.

Solar One is the world's largest solar thermal central receiver electric power plant. It is currently in the midst of a two-year Experimental Test and Evaluation phase which began in August 1982. The plant is designed to operate in 8 basic operating modes (including shutdown) which are intended to demonstrate and fully exercise the energy collection, energy storage, and power genera-

tion features of a central receiver system. During Mode 1 operation, which is the subject of this report, all of the collected solar energy is converted into superheated steam in the receiver with the steam then flowing directly to the turbine for electrical power production. Neither the charging nor discharging features of the thermal storage system are involved in this operation. This report contains baseline plant design information pertinent to Mode 1 operation and presents the results of the Mode 1 test activities. The Test Results section of the report includes information regarding steady state plant performance at both design and off design conditions, plant startup and shutdown transitions, and plant trips.

4508 **(SAND—84-8237) Data evaluation plan for the 10 MWe solar thermal central receiver pilot plant power production phase.** Radosevich, L.G. (Sandia National Labs., Livermore, CA (USA)). Oct 1984. Contract AC04-76DR00789. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002863.

This report describes the planned data evaluation for the three-year Power Production Phase of the 10 MWe Solar Thermal Central Receiver Pilot Plant near Barstow, California. The Power Production Phase, which began in August 1984, will demonstrate the operational capability of the plant to reliably supply electrical power to the utility grid. Data evaluation will be performed for design point and annual plant energy output; heliostat optical performance and mirror module corrosion; receiver tube life and absorber coating life; storage fluid degradation and storage tank thermal stresses; plant availability, operating procedures, and operating costs; and component reliability and maintenance costs. The objective, test needs, data needs, approach, expected output, and planned data dissemination are presented for each evaluation.

4509 **(SERI/TP—252-2337) Direct-contact condensers for solar pond power plants.** Fisher, E.M.; Wright, J.D. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1984. Contract AC02-83CH10093. 10p. (CONF-841201—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84013026.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

Direct-contact condensers for an organic Rankine cycle solar pond power plant are compared with conventional shell-and-tube condensers. Three types of direct contact systems are evaluated: drop type, bubble type, and packed columns. Methods used in the design of the direct contact systems are reviewed. Complete 5 MW/sub e/ plants, including the solar pond, are designed for each system, and their capitalized costs compared. Direct contact condensers were found to be considerably less expensive than shell-and-tube condensers. However, the auxiliary equipment needed to prevent the buildup of noncondensables and to control working fluid losses negated much of the cost savings. Also, the direct contact systems were less efficient. Thus no significant advantages were found for the direct contact condenser systems.

4510 **Solar thermal power towers.** Kreith, F.; Meyer, R.T. (Solar Energy Research Inst., Golden, Colorado). *International Journal of Solar Energy;* **2**: No. 5, 385-404(Jul 1984).

The solar thermal central receiver technology, known as solar power towers, is rapidly evolving to a state of near-term energy availability for electrical power generation and industrial process heat applications. The systems consist of field arrays of heliostat reflectors, a central receiver boiler, short term thermal storage devices, and either turbine-generators or heat exchangers. Fluid temperature up to 550°C and currently achievable, and technology developments are underway to reach 1100°C. Six solar power towers are now under construction or in test operation in five countries around the world.

4511 **Assessing the environmental impacts of solar/fossil power plants.** Hunsaker, C.T.; Hunsaker, D.B. (Oak Ridge National Lab., Oak Ridge, TN 37830). *Environmental Impact Assessment Review;* **4**: No. 1, 242-248(Mar 1984).

Hybrid solar/fossil power plants have been proposed as a technology that would minimize the disadvantages and maximize the advantages of solar and fossil power plant technologies. The development of hybrid solar/fossil power plants is in its infancy. This paper presents an assessment method to quickly identify the major environmental impacts of this new technology, and to determine whether it offers any advantages or disadvantages over either an exclusively solar or coal-fired plant.

1408 Ocean Energy Systems

4512 **(DOE/CE/30718—T1) Correlation and reassessment of the OTEC plant power cycle. Final report.** Heydt, G.T.; Leidenfrost, W.; McDonald, A.T.; Ogborn, L.L. (Purdue Univ., Lafayette, IN (USA). Inst. for Interdisciplinary Engineering Studies). Jul 1984. Contract AC01-82CE30718. 247p. NTIS, PC A11/MF A01. File Number DE84015467.

The purpose of this effort is to investigate alternative system concepts and component configurations to improve performance of the OTEC power system. Reliability, Availability, and Maintainability (RAM) characteristics were examined along with various methods of converting energy into utility-grade energy. A research program consisting of five tasks was developed: development of engineering guidelines for OTEC systems; thermal and mechanical evaluation of components; evaluation of electrical system requirements; evaluation of operating strategies for OTEC plants; and application of modern technology to OTEC design choices. These studies are discussed in detail along with recommendations and conclusions.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 1409004440, 4555, 4826, 4841, 4842, 4843

4513 **(BMFT-FB-T—84-159) Heat pump with new screw-compressor, gas engine and absorber roof.** Gondro, B.; Holz, W.; Moetz, K.; Willeitner, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Muenchen (Germany, F.R.). Bereich Neue Technologie). Jul 1984. 112p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84752281.

Heat pumps driven by internal combustion engines have the advantage that not only the multiple heat derived from mechanical energy but also the waste heat from the engines is used. Solar heat can be used as the source of energy: this is led to the evaporator via an absorber roof and an appropriate brine circuit. This guarantees that heat can be generated from the environment without noise and without maintenance. On this basis, a heat-pump system was constructed in co-operation with Kabelmetal in an old people's home in Esslingen. This system is connected to a heating oil boiler and is used to heat the 43 apartments and to produce the necessary heat for the water. The system was in operation for two heating periods between late 1980 and early 1982 and ran for a total of approx. 4000 hours. This report describes the construction of the system and the evaluation of the measurements taken.

4514 **(CONF-820940—Suppl.) Passive and hybrid solar manufactured housing program, Phase 2. Design of the solarium house prototype direct gain house prototype.** Usry, J.D. (Usry, Inc., Richmond, VA (USA)). Nov 1982. Contract FC02-80CS30385. 113p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001480.

From Passive and hybrid solar energy update conference; Washington, DC, USA (15 Sep 1982).

The goal of this project is to create widespread production and sales of energy conserving passive solar heated and cooled manufactured homes. All completed buildings will be built in a factory utilizing wood construction and integrating applied and accepted on-site construction techniques. The Usry design team has evaluated many processes of construction and has determined that environmentally controlled manufactured systems are much more cost efficient as well as quality coordinated. Utilizing certain preliminary market assessments in the Richmond metropolitan area, it was determined that a typical home consisting of 1000 to 1600 square feet would be most favorable.

4515 (DOE/CE/30740—1) Experimental and theoretical study of thermal performance of hybrid solar system. Final technical report. (Dulaney and Associates, Des Moines, IA (USA)). 21 Sep 1984. Contract FG02-82CE30740. 84p. NTIS, PC A05. File Number DE85002183.

The work under this revised grant included three major areas. The end result of all three of these phases of the work was the completion of construction of the Farm House of The Future at Living History Farms. The Farm House will be a museum open to the public and dedicated to the demonstration of the latest advances in farming and farm living. The house contains approximately 3200 square feet and is designed to incorporate the best in energy related technology that is available today. The major energy conserving concepts developed in the design of the house include passive solar, earth sheltering, and a salt gradient solar pond. Preliminary studies done on the building systems indicated the house would be able to provide approximately 95% of its heating needs without the use of non-renewable energy sources. The three areas involved in the work of this grant include: thermal analysis of the house and pond; construction documents including architectural, structural, and mechanical work; and construction of the 3200 ft^2 residence.

4516 (DOE/CS/30370—1) Passive solar heating systems design. Final report. (Dynamic Homes, Inc., Detroit Lakes, MN (USA)). [1984]. Contract FC02-80CS30370. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000180.

In 1979 Dynamic Homes submitted a winning proposal in a Department of Energy passive and hybrid solar manufactured housing competition in the modular construction category. A set of preliminary designs for various housing types (ramblers, split entries, split levels, and two stories) were developed. The split entry designs seemed most feasible. They provided a good product at a price that could be marketable. It was decided to proceed with the split entry designs and three models were developed - two single-family and one duplex. Plans and descriptions are presented.

4517 (DOE/ET/20642—T2) SOLERAS Program: engineering field test of a solar cooling system. Phase I and II. (United Technologies Research Center, East Hartford, CT (USA)). Jun 1982. Contract FC02-80ET20642. 251p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85000055.

The rationale for selecting the engineering field test site and the building cooling requirements are described. Descriptions of the Phase I activities are presented and descriptions of the overall cooling system and its major subsystems and components are provided. The preliminary design analyses conducted to select collector/storage, chiller module and thermal distribution components; operating features and estimated system performance are included. Economic analyses and the results obtained are described including an assessment of the commercialization potential for the solar cooling system. Phase II activities are presented and detailed design, construction and installation features of the solar system at the test site are described. Testing documentation is provided by the checkout and acceptance tests and their results are described.

4518 (EUR—8523-EN) Solar energy. Annual status report 1982. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1982. 12p. Commission of the European Communities, Luxembourg.

To develop alternatives able to complement or replace present energy sources in order to reduce the dependency from imported primary energies is the main objective of research activities on solar energy sponsored by the Commission of the European Communities. The programme is structured in four research projects: ESTI (European Solar Test Installation); Habitat and low-temperature applications, for the study and modelling of integrated systems for heating and cooling; Solar power plant materials; Photoelectrochemical and photochemical energy conversion. The brochure gives a brief account of the various research activities, describing the test facilities, data acquisition systems, and the results obtained. The research work carried out over the past 3 years has brought about information useful for orienting future development work, as for instance on testing methods, performance evaluation, and systems reliability and durability.

4519 (N—84-26126) Cooling-load implications for residential passive solar heating systems. Jones, R.W.; Mcfarland, R.D. (Los Alamos Scientific Lab., NM (USA)). Nov 1983. 7p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 2-8, N—84-26125 16-44.

The quantification of cooling loads in residential buildings, particularly buildings with passive solar heating systems, is described, along with the computer simulation model used for calculating cooling loads. A sample of interim results is also presented. The objective of the research is to develop a simple analysis method, useful early in the design, to estimate the annual cooling energy requirement of a given building.

4520 (N—84-26127) Correction factor to f-chart predictions of active solar fraction in active-passive heating systems. Evans, B.L.; Beckman, W.A.; Duffie, J.A.; Mitchell, J.W.; Klein, S.A. (Wisconsin Univ., Madison (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 9-14, N—84-26125 16-44.

The extent to which a passive system degrades the performance of an active solar space heating system was investigated, and a correction factor to account for these interactions was developed. The transient system simulation program TRNSYS is used to simulate the hour-by-hour performance of combined active-passive (hybrid) space heating systems in order to compare the active system performance with simplified design method predictions. The TRNSYS simulations were compared to results obtained using the simplified design calculations of the f-Chart method. Comparisons of TRNSYS and f-Chart were used to establish the accuracy of the f-Charts for active systems. A correlation was then developed to correct the monthly loads input into the f-Chart method to account for controller deadbands in both hybrid and active only buildings. A general correction factor was generated to be applied to the f-Chart method to produce more accurate and useful results for hybrid systems.

4521 (N—84-26128) Measured versus predicted performance of the SERI test house: a validation study. Judkoff, R.; Wortman, D.; Burch, J. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. 10p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 15-24, N—84-26125 16-44.

The reliability of building energy analysis simulations was investigated by testing key algorithms against detailed thermal performance data collected under controlled building operating conditions. Comparative studies showed significant disagreement among several programs when used to simulate the performance of passive solar buildings. The sources of prediction errors were assessed.

4522 (N—84-26129) Systems integration of photovoltaic and passive solar. Krantz, A.D. (Department of Energy, Washington, DC (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 25-30, N—84-26125 16-44.

Photovoltaic technology and its adaptation to single family houses are described briefly. Design and insitutional issues are discussed. Expected technological and commercial advances in photovoltaic techology are identified.

4523 (N—84-26130) Energy and peak power saved by passively cooled residences. Clark, G.; Loxsom, F.; Doderer, E.; Vieira, R.; Fleischhacker, P. (Trinity Univ., San Antonio, TX (USA)). Nov 1983. 7p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 32-38, N—84-26125 16-44.

The energy displacement potential of roof pond cooling in humid climates is sensitive to the type of dehumidification equipment employed and the humidity levels allowed. The simulated energy requirements of roof pond residences assisted by two high efficiency dehumidifier options are described. One dehumidifier was a vapor compression air conditioner with sensible cooling recovery by an air-to-air heat exchanger (improved mechanical dehumidifica-

tion or IMD). The second option was a solar regenerated desiccant dehumidifier (SRDD). An IMD assisted roof pond house had energy savings of 30 to 65% in humid climates compared to the conventional house an SRDD assisted roof pond house had energy savings of 70 to 75% in humid climates.

4524 **(N—84-26134) Status of the class A performance evaluation program.** Hunn, B.D. (Los Alamos Scientific Lab., NM (USA)). Nov 1983. 8p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 63-69, N—84-26125 16-44.

A program to collect, analyze, and archive detailed test data for the rigorous validation of analysis/design tools used for passive solar research and design is described. Program accomplishments in the areas of: (1) data needs and test facilities, (2) development of a validation methodology, and (3) collection, analysis, and archiving of test data are presented. The primary work reported is in the third area, where several high-quality data sets were analyzed by comparison with public-domain passive solar analysis tools. Measured-versus-predicted results are presented in a standard graphical and statistical summary format.

4525 **(N—84-26135) Results from the NBS passive test building: a status report.** Mahajan, B.M.; Liu, S.T. (National Bureau of Standards, Washington, DC (USA)). Nov 1983. 8p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 71-78, N—84-26125 16-44.

A passive solar test building, which has been operational since October 1981 is described. The test building was constructed to acquire class A performance monitoring data for various passive systems under different experimental conditions. The test building, instrumentation and data acquisition system, continuous air infiltration monitoring system and experimental work conducted are described. The report contains representative data, and briefly describes the research activities planned for the future.

4526 **(N—84-26136) Parameter estimation and infiltration tests at the repeat facility.** Burns, P.; Armstrong, P.; Winn, B. (Colorado State Univ., Fort Collins (USA)). Nov 1983. 7p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 80-86, N—84-26125 16-44.

Work performed in the reconfigurable passive evaluation analysis and test (REPEAT) facility is reviewed. The physical characteristics of the building and the instrumentation are described. Collected data are discussed. Treatment of parameter estimation ensures with example calculations. Infiltration instrumentation and tests are described. Flow visualization studies are discussed.

4527 **(N—84-26137) Passive solar manufactured buildings development and analyses.** Dekieffer, R. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 87-91, N—84-26125 16-44.

Manufactured buildings which are cost effective residential and light commercial buildings are discussed. The solar energy research institute (SERI) and the Department of Energy (DOE) worked with building manufacturers design, develop, and build passive solar manufactured buildings. This development process lead to valuable information in design development and design options, cost analysis, and estimated and monitored thermal performance on all types of manufactured buildings. The scope and content are described.

4528 **(N—84-26138) Measured performance of 50 passive solar residences in the United States.** Swisher, J.N.; Duffy, J.J. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 93-97, N—84-26125 16-44.

The thermal performance of 50 passive solar residences in a variety of U.S. locations is summarized. These buildings were monitored as part of the Solar Energy Research Institute (SERI) Residential Class B Passive Solar Performance Monitoring Program. The monitoring and performance evaluation methods are described and the overall heating season performance of the buildings are presented in graphical form. The validity of extrapolating the data generated to passive solar buildings in general is discussed.

4529 **(N—84-26139) Development of an industry-based residential thermal program evaluation program.** Frey, D.J.; Collins, B.D.; Kando, P.F. (National Association of Home Builders Research Foundation, Inc., Rockville, MD (USA)). Nov 1983. 4p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 99-102, N—84-26125 16-44.

A multi-year program to develop methodology and equipment for providing the construction industry with meaningful information on the performance of passive solar housing is outlined. The tasks and subtasks involved in project management are presented.

4530 **(N—84-26140) International energy agency solar heating and cooling programme: Task 8, passive and hybrid solar low energy buildings.** Holtz, M.J. (National Association of Home Builders Research Foundation, Inc., Rockville, MD (USA)). Nov 1983. 9p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 104-112, N—84-26125 16-44.

The background of and results achieved by the International Energy Agency are discussed. Task objectives approach, and participants are presented as well as results from two international surveys on simulation models and design tools. Conventional reference buildings are described representative of typical design and construction practice in each country and will be used as a basis of comparison to passive/hybrid designs developed. Work in progress is briefly described along with Agency information dissemination activities.

4531 **(N—84-26141) DOE passive solar commercial buildings program: preliminary results of performance evaluation.** Lutha, R.; Rockwell, P.G. (Burt-Hill-Kosar-Rittelmann Associates, Washington, DC (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 113-117, N—84-26125 16-44.

The U.S. Department of Energy is conducting performance evaluation of the buildings in the Passive Commercial Buildings Program. The objectives of the effort are: (1) to determine how much auxiliary energy is being saved by these passive solar buildings over non-solar buildings, and (2) to determine whether the buildings function, or are perceived to function, as well as non-solar buildings. Some preliminary results of the evaluation are: that the buildings are, in fact, saving significant amounts of energy in comparison to non-solar buildings that majority of the occupants are satisfied overall with the buildings that occupancy of the buildings can be substantially different than what was assumed during design and that passive buildings require a great deal of communication between designers, vendors, and contractors for successful construction.

4532 **(N—84-26142) Field instrumentation for the passive solar commercial buildings monitoring program.** Frey, D.J. (Architectural Energy Corp., Westminster, CO (USA)). Nov 1983. 2p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 119-120, N—84-26125 16-44.

Twenty commercial buildings have been built with partial funding from the U.S. Department of Energy (DOE) as part of the Passive Solar Commercial Buildings Program. Project teams associated with each building have a contractual responsibility to provide DOE with energy consumption data for major end-uses. The objectives of the work being performed by Architectural Energy Corporation (AEC) are: (1) to add consistency, reliability and accuracy to the individual monitoring projects (2) to prepare the continuously collected data in a common format for archival by the A.I.A. Foundation and (3) to provide data to Lawrence Berkeley Laboratory (LBL) for daylighting studies in two of the buildings.

4533 **(N—84-26143) Thermal effects resulting from occupant behavior and building operation.** Andersson, B.; Adegran, M.; Webster, T.; Kammerrud, R.; Place, W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1983. 7p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 122-127, N—84-26125 16-44.

Issues related to occupant activity in passive commercial buildings were investigated to determine their energy impacts. Total building energy analyses were performed to identify the heating, cooling and lighting effects of a variety of occupant requirements and activities. The evaluation phase of the Passive Commercial Experimental Buildings Program is described the interaction of occupancy and thermal/energy evaluation is discussed. The methods used to evaluate the effect of occupants on daylighting performance in two of the buildings are described and progress on that activity is detailed. Preliminary results of investigations into occupant-related aspects of the use of thermal mass in commercial buildings and analysis plans for further investigation are presented. Additional areas of investigation are identified and discussed.

4534 **(N—84-26144) Users ruin design intentions.** Kantrowitz, M. (Kantrowitz (Min) and Associates, Inc., Albuquerque, NM (USA)). Nov 1983. 6p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 129-135, N—84-26125 16-44.

The approach to examining the relationship between occupants and energy use currently being implemented through the U.S. Department of Energy Passive Solar Commercial Buildings Program is described. Preliminary findings related to how occupant behavior influences energy use and how users respond to these passive solar commercial buildings are presented. Most building users seem to be satisfied with conditions in the buildings-the patterns of the relatively few complaints about comfort reveal cool, sometimes drafty mornings and warm afternoons. Some concern about acoustics was also expressed. The issue of user operations in the buildings is a more pervasive one-there are many instances of improper operations of the buildings, due to a variety of factors. There is a need for clear, well managed user orientation programs, and an explicit transfer of responsibility for certain building operations to the users.

4535 **(N—84-26147) Survey of design tools for passive and hybrid low energy buildings.** Rittelmann, P.R.; Davy, J.E.; Ahmed, S.F. (Burt, Hill, Kosar, Rittlemann, and Associates, Butler, PA (USA)). Nov 1983. 8p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 146-151, N—84-26125 16-44.

Design tools for passive and hybrid low energy buildings were surveyed as part of the solar heating and cooling program. A total of 164 design tools were surveyed. The design tools are categorized in various ways. The need for further design tools development for certain application is identified.

4536 **(N—84-26148) Development of an evaluation methodology for passive solar design tools.** Willman, A.J. (American Consulting Engineers Council, Washington, DC. Research and Management Foundation). Nov 1983. 4p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 155-158, N—84-26125 16-44.

The progress in developing an evaluation methodology for passive solar design tools is described. Four subtasks are described: (1) an identification of previous design tool evaluation attempts (2) the development of a categorization method for building energy design tools. The third and fourth subtasks will build on the first two to develop the evaluation procedure. The planned activities of these two subtasks are described.

4537 **(N—84-26149) Multi-family update to the passive solar construction handbook.** Howard, B.D.; Callahan, K.D. (National Concrete Masonry Association, Herndon, VA (USA). Technical Services Div.). Nov 1983. 5p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 160-164, N—84-26125 16-44.

Builders and developers will accept passive solar construction and designs for integration with their existing practice if accurate and detailed plans of actual, proven passive solar subsystems and assemblies are made available to them. A Passive Solar Construction Handbook was developed. It focuses primarily upon single family homes. The multifamily update of the Handbook, is described and examples of the valuable builder information are shown. It represents a new breakthrough in DOE sponsored projects, performing a Technology Transfer on a most useful level.

4538 **(N—84-26150) Overview of Roof Pond Systems.** Marlatt, W.P.; Murray, K.A.; Squier, S.E. (Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center). Nov 1983. 2p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 165-166, N—84-26125 16-44.

An overview of a technical report on roof pond systems is presented. The document discusses how the information for the report was gathered, the contents of the report, and the current status of completion. A summary of the impact of the report on the solar community and a general conclusions are included as well as information on the availability of the report.

4539 **(N—84-26151) Transfer of passive research and development results to industry and the user community.** Moran, H.D. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. 4p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 168-171, N—84-26125 16-44.

The Federal investment in research and development of renewable energy technologies which is valuable if the results of such R D are transferred to the private sector, which result in products and processes of benefit to society. The Passive and Hybrid Solar Energy Program is one for which Congress has designated specific funds to support technology transfer. A Passive Technology Transfer Plan was established which employs both established mechanisms and innovative approaches to fostering the prompt transfer of new technologies to private and public sector users. Key to the success of this plan is the participation of both user representatives and intermediaries in the transfer process.

4540 **(NP—5770023) Simulation and profitability of air-collector storage systems for solar-aided drying exemplified by tobacco.** Bolst, K. (Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau). 1 Jul 1983. 188p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85770023.

Operation behaviour and output behaviour of a solar tobacco drying facility was studied by means of a simulation model. A method was chosen resolving the complicated process ranging from identification of the real system to validation of the finished model, into several discernable and controllable steps. A flexible model of the solar facility with a great variety of applications was developed while exploiting the full capacity range of a TRNSYS simulator. Model qualifications and validation results are given. The results of a comprehensive profitability analysis show that, even at optimistic assumptions concerning coverage proportion, the real facility will pay back only when based on favourable economic parameter constellations. The analysis of the calculation runs shows that the facility will be undercharged to capacity in the first drying stage and overloaded in the third if the whole cycle is supplied by one collector field only.

4541 **(NP—5770024) Experimental and numerical studies on an open adsorption system for solar space-cooling.** Bassols-Rheinfelder, J. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 13 Dec 1982. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85770024.

Open adsorption systems with a solid adsorbant were studied for their possible application in solar space-cooling. Such a facility has the advantages that only air is employed as the working fluid, that no corrosive fluids are applied and that the facility functions at atmospheric pressure. Ambient-air humidity is of great importance

when dimensioning such facilities, since increased moisture necessitates large quantities of adsorbants thus rendering operation more expensive in terms of money and material. Open adsorption systems, therefore, are best applied in areas where a high ambient temperature is accompanied by low air humidity. The following items are reported in detail: experimental studies, establishment of a simulation program, adaptation to experimental findings and simulation of the total refrigeration facility including the components of solar collector, adsorption columns, air humidifier, heat exchanger and stone storage units.

4542 **(NP—5900014) Analysis model survey.** Joergensen, O. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Dec 1983. 185p. NTIS (US Sales Only), MF A01. File Number DE85900014.

Subtask B, Modelling and Simulation, is one of several subtasks of Task VIII, Passive and Hybrid Solar Low Energy Buildings of the IEA Solar Heating and Cooling Programme. One of the objectives of this subtask is to evaluate current analysis models for passive and hybrid systems in the member countries. This report documents the first step of this evaluation process, namely a survey of the models that are available, as well as their analysis capabilities and limitations. The reader is provided with a full set of completed survey forms and five summary tables to assist in the selection of an appropriate model for a specific problem.

4543 **(NP—5900015) Data requirements and thermal performance evaluation procedures for solar heating and cooling systems.** Streed, E.R. (ed.). (National Bureau of Standards, Washington, DC (USA)). Aug 1979. 85p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85900015.

This document provides standardized nomenclature and procedures to serve as a guide to monitor and evaluate research or demonstration type solar hot water or heated and/or cooled systems, components and buildings. Performance factors, data requirements, measurement parameters and data analysis methods are described for typical solar energy systems. The document has resulted from the review and comments submitted by representatives of countries participating in Task 1. Material developed by the United States for use in the National Solar Heating and Cooling Demonstration Program and published as NBSIR 76-1137, was used as the primary reference. The contact persons for each country participating in Task 1 are listed in Appendix A.

4544 **(NP—5900107) MINSUN simulation and optimization program: application and user's guide.** Chant, V.G.; Hakansson, R. (eds.). (National Research Council of Canada, Ottawa, Ontario; Studsvik Energiteknik AB, Nykoeping (Sweden)). Dec 1983. 223p. NTIS (US Sales Only), PC A10/MF A01. File Number DE85900107.

This report summarizes the work carried out in Sub-Task I(a), Systems Studies and Optimization, of Task VII, Central Solar Heating Plants with Seasonal Storage (CSHPSS), of the IEA Solar Heating and Cooling Program. The objectives of Sub-Task I(a) were: to develop procedures and analytic tools for studying system feasibility and for evaluation, and to recommend specific systems analysis procedures and tools for use in Sub-Task I(e), Site-Specific Preliminary Design, and Phase II of Task VII. The approach adopted for Sub-Task I(a) was to select, modify and further develop two analytic tools as design aids for CSHPSS and to examine the appropriateness of these tools by undertaking application case studies. The principal analytic tool is the MINSUN Program for simulation and optimization of CSHPSS. This report presents an overview of the MINSUN set of programs and its application in the analysis of CSHPSS. It also provides detailed descriptions of what input parameters must be defined by the user and how to interpret the program output and results. Information is provided on the thermal simulation and economic analysis aspects of the program such that the user may make minor modifications in order to represent a CSHPSS configuration or control strategy that is not readily modelled by the existing options within MINSUN. Sample program input and output formats and data sets are presented in the appendices.

4545 **(SERI/TP—253-2465) Core daylighting: a new approach for non-residential buildings.** Robbins, C.L. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 7p. (CONF-8409118—7). NTIS, PC A02. File Number TI84013041.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

There is a considerable amount of research currently being conducted on a variety of advanced core daylighting concepts, although much of the effort is still in the early experimental stages. This paper focuses on only these advanced concepts, daylighting heliostats, because there is sufficient research to report and because some heliostat systems are already being used to illuminate the interior of buildings. This paper outlines a method developed to analyze the performance characteristics of heliostat systems that use a primary and secondary reflector system. Although there are several different heliostat systems that can be used for solar thermal applications, there are only three developed that use a primary/secondary reflector system for daylighting purposes. These are azimuth tracking, fixed altitude systems; altitude tracking, fixed azimuth systems; altitude/azimuth tracking systems.

4546 **(SERI/TP—253-2476) What do hourly performance data on a building tell us.** Subbarao, K. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1984. Contract AC02-83CH10093. 8p. (CONF-840954—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000527.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

Hourly performance data on a building contain valuable information on the dynamics of the building and of the HVAC systems. Quantities such as the building loss coefficient, solar gains, and the net effect of thermal masses and their couplings are all contained in the data. The building element vector analysis (BEVA) method has been applied to a multizone residential passive solar building monitored under the SERI Class B program. Using short-term data (approximately one week), the building parameters were regressed. With these as inputs, the subsequent performance of the building was well predicted. Using performance data for the period February 3-9, 1982, the building vectors were obtained by regression. The resulting best fit for the zone temperature is given. These parameters were used to predict the temperature for the period February 10-14. The resulting values are also plotted along with the outdoor temperature, solar radiation on a south vertical surface, and auxiliary energy for these periods.

4547 **(SERI/TP—255-2455) Solid state electrochromic switchable window glazings.** Benson, D.K.; Tracy, C.E.; Ruth, M.R. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1984. Contract AC02-83CH10093. 10p. (CONF-840872—32). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000513.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

Multilayer, solid state electrochromic coatings based on a-WO_3 (amorphous WO_3) have been tested. A typical coating on glass consists of indium-tin oxide (520 nm), WO_3 (410 nm), MgF_2 (170 nm) and gold (15 nm) all deposited by vacuum evaporation. Optical spectra and solar weighted, integrated transmission values are given for the component films and complete multilayer devices. Electrical characterisitcs and electrooptic responses are reported. Devices with MgF_2 layers deposited at low pressures have high internal resistances and exhibit long term optical term memories suitable for diurnal switching. The replacement of the gold electrode layer with an indium-tin oxide layer greatly increases the transmittance of the electrochromic coating stack (from solar weighted transmission of 22% to 53%). Electrochromic coatings have promise for solar gain control windows, but further improvements in optical and electrical efficiencies are needed.

4548 **(SERI/TR—252-2464) Facility design for cyclic testing of advanced solid desiccant dehumidifiers.** Schlepp, D.; Schultz, K.; Zangrando, F. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1984. Contract AC02-83CH10093. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85000510.

The development of high performance components is required to reach the goal of desiccant cooling system cost-competitiveness with conventional vapor compensation air conditioning systems. SERI has designed a laminar flow, parallel passage dehumidifier that has this potential. The goal of SERI's desiccant cooling research program is to fully characterize experimentally the performance of the parallel passage dehumidifier under a wide range of operating conditions, investigate improvements in design, and verify existing models of dehumidifier performance against experimental results. This report documents the design of the SERI Desiccant Cooling Test Facility for performing the above testing. With slight modifications, the testing can be used for testing other desiccant cooling system components. The dehumidifier processes and the parameters and variables needed to control and characterize its performance are presented. The physical layout of the test loop and instrumentation for monitoring the operating conditions and dehumidifer performance and the controls for maintaining the operating conditions are specified. The computerized data acquisition system conversion equations and an error analysis of measurement variables are also presented.

4549 **(TUM-M—8310) Numerical calculation of optimum control of heating and cooling for a realistic model of a solar house.** Oberle, H.J. (Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Mathematik). Aug 1983. 93p. (In German). Library of Technische Univ. Muenchen (Germany, F.R.).

Optimum control of heating and cooling of a solar house was calculated. When selecting the deviation of internal temperature from the desired temperature as the target functional, an optimum control will obtain with a given dimensioning of heating and cooling facilities which, however, does not allow for energy consumption. The necessary conditions of variation calculation were established for a numerical solution of these optimization tasks. Realization in the form of an "almost-optimum" control is suggested for practical application. The second set of optimization tasks allows for energy consumption. An appropriate model provides a correlationship between energy conservation and its result, the average quadratic deviation of internal temperature and desired temperature. Energy savings obtained with a tolerable average temperature deviation largely depends on the season involved. With extreme external temperatures, energy conservation is obtained at 5 to 10% per degree of average temperature deviation whereas significantly increased savings can be obtained during transition periods between seasons.

4550 **(WPS—3-82.09.R335) Optimization of the flows in a solar heating system.** Veltkamp, W.B.; van Koppen, C.W.J. (Technische Hogeschool Eindhoven (Netherlands)). Sep 1982. 71p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

A solar heating and hot water system behaves non-linearly as regards the flows through the collector and the flows at both sides of the heating system. Therefore a thought-out control strategy for the flows is necessary in order to maximize the heatgain of the system. This study concerns the control strategy for a solar heating and hot water system with a thermally stratified storage. After deriving the near optimal control strategy with modulating flows for such a system it is showed that this strategy can be approximated by using on-off control and fixed flows without loosing more than 1% of the energy displaced. Optimizing this much simpler approach for an air heating system it is subsequently showed that the yearly load capacitance throughput (secondary side air heater) should be somewhat higher than the primary load capacitance throughput and the latter should be somewhat smaller than the yearly collector capacitance throughput, in order to obtain the highest solar heat gain. These results are virtually independent of the system parameters. The new control strategy generally leads to much lower flow rates throughout the system than are commonly applied. From a comparison of the displaced energies it appears that the flow strategy combined with stratified storage brings with it improvements of up to 35%. A fast method for determining the optimum flow is proposed. This report was prepared in the framework of the Dutch Solar Energy R and D Program under contract with the Project Office for Energy Research. (J.C.R.)

4551 **The sunspace primer. A guide for passive solar heating.** Jones, R.W.; McFarland, R.D. New York, NY, USA; Van Nostrand Reinhold (1984). 320p.

A comprehensive but not highly technical introduction to passive solar heating with an attached sunspace. Emphasis on performance concepts and design principles helps users understand the six functional aspects of a sunspace-solar energy, glazing, heat storage, conservation, distribution, and controls. Special attention is given to how to optimize each element of a sunspace for solar heat production. Maps reveal the heat production potential of various designs for many locations in the southern U.S. Useful coverage is provided of reflectors, glazing, tilts, shades, and vents. Also included is a survey of sunspace glazing materials and a list of manufacturers.

4552 **Mass and fans in attached sunspaces.** Jones, R.W.; McFarland, R.D. (Los Alamos National Lab., Los Alamos, NM 87545). pp 81-90 of Energy conserving greenhouses: horticulture and technology working together. Hayes, J.; Wilson, A. New York, NY, USA; American Solar Energy Society, Inc. (1983). (CONF-821156—).

From 3. energy conserving greenhouse conference; Hyannis, MA, USA (19 Nov 1982).

The effect of thermal storage mass on the performance of an attached sunspace is investigated for a particular design in Boston. Mass in the sunspace and in the adjoining building are compared. Performance is evaluated in terms of temperature conditions in the sunspace and delivery of useful solar heat to the adjoining building. The dependence of the results on the manner of heat delivery is studied. Both natural convection and fan-forced air flow are included.

4553 **PSDESIGN; a microcomputer analysis tool for the passive solar designer/builder.** Hollander, P.; Darling, R. (Cornerstones Energy Group, Inc., 21 Stanwood Str., Brunswick, ME 04011). pp 177-180 of Energy conserving greenhouses: horticulture and technology working together. Hayes, J.; Wilson, A. New York, NY, USA; American Solar Energy Society, Inc. (1983). (CONF-821156—).

From 3. energy conserving greenhouse conference; Hyannis, MA, USA (19 Nov 1982).

Studies have indicated the need for a passive solar design tool that offers decision-making as well as design information. It must also be easy to use, require only small investments in time and money and not require excessive expertise. PSDESIGN has been developed with these needs in mind. It is a microcomputer program for most 48K and 64K machines. PSDESIGN is based on the SLR method developed at Los Alamos National Laboratory. It contains data for 219 cities and 94 system types. It calculates the optimum mix between conservation and passive solar, solar savings fraction, auxiliary energy requirement and cost, temperature swing for a clear January day and mass size.

4554 **SLR methods for attached sunspaces.** Jones, R.W.; McFarland, R.D. (Los Alamos National Lab., Los Alamos, NM 87545). pp 163-172 of Energy conserving greenhouses: horticulture and technology working together. Hayes, J.; Wilson, A. New York, NY, USA; American Solar Energy Society, Inc. (1983). (CONF-821156—).

From 3. energy conserving greenhouse conference; Hyannis, MA, USA (19 Nov 1982).

Solar load ratio (SLR) methods applied to sunspaces are reviewed. Procedures are described both for the 28 sunspace basic design types and for the design variations that can be accommodated within the SLR method. Emphasis is placed on aspects of design, operation, and analysis that relate to the production of both plants and heat. Issues discussed include geometry, shading of mass, temperature limits, and energy loss caused by the exfiltration of water vapor.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 1410004486, 4487, 4490, 4491, 4493, 4494, 4495, 4497, 4501, 4518, 4547, 4871

4555 (BMFT-FB-T—84-039) Flat plate collectors as facade elements for domestic hot water and heat insulation. Flamm, H.; Lochau, R.; Maeiss, M.; Schiele, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Technische Fachhochschule Berlin (Germany, F.R.)). Jul 1984. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752283.

In a newly constructed south-west-facade 200 m^2 of flat plate collectors were integrated as construction elements to heat domestic water. The building needs 5-10 m^3 of hot water per day, i.e. 250-500 kWh/d. The solar circuit runs with a water-glycol-mixture with a specific volume flow rate of 20-40 l/m^2h. The storage capacity is 8 m^3, i.e. 40 l/m^2 collector area. The heating system is bivalent. The total cost was DM 220.000, excepting the cost of facade construction. The observation period was 2 years. The heat flow balance was measured daily using a microprocessor. As far as the construction was concerned, there were no defects during the observation period. The rooms behind solar collectors showed no additional thermal load. The most favourable season for running solar systems is from April to September. In this period the average efficiencies were 15 to 20%, the net energy yield was 76 kWh/m^2.

4556 (N—84-25171) Operational demonstration of a field of high performance flat plate collectors with isothermal heat transport. Final report, December 1982. Merges, V.; Klippel, E. (Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (Germany, F.R.)). Dec 1983. 37p. (BMFT-FB-T—83-2). NTIS, PC A03/MF A01.

A solar plant with 21 sq m of highly efficient flat plate collectors and which requires no electricity is described. Heat transport is provided by saturated steam that condenses in a four cubic meter storage tank. The operation temperature is set by the buffer gas pressure between 100 and 140 C, and an absorption chiller is simulated as a heat consumer. The solar collectors were observed to exhibit high performance. Heat transport and temperature control offered high reliability and the thermal stratification in the tank was satisfactory. The positive result permits the design and construction of larger solar plants following the same technical principles.

4557 (N—84-28212) CONC/11: a computer program for calculating the performance of dish-type solar thermal collectors and power systems. Jaffe, L.D. (Jet Propulsion Lab., Pasadena, CA (USA)). Feb 1984. 148p. (NASA-CR—173735; JPL-PUBL—84-9). NTIS, PC A07/MF A01.

The CONC/11 computer program designed for calculating the performance of dish-type solar thermal collectors and power systems is discussed. This program is intended to aid the system or collector designer in evaluating the performance to be expected with possible design alternatives. From design or test data on the characteristics of the various subsystems, CONC/11 calculates the efficiencies of the collector and the overall power system as functions of the receiver temperature for a specified insolation. If desired, CONC/11 will also determine the receiver aperture and the receiver temperature that will provide the highest efficiencies at a given insolation. The program handles both simple and compound concentrators. The CONC/11 is written in Athena Extended FORTRAN (similar to FORTRAN 77) to operate primarily in an interactive mode on a Sperry 1100/81 computer. It could also be used on many small computers. A user's manual is also provided for this program.

4558 (N—84-28217) Solar parabolic dish technology evaluation report. Lucas, J.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Apr 1984. 37p. (NASA-CR—173725; JPL-PUB—84-25). NTIS, PC A03/MF A01.

The activities of the JPL Solar Thermal Power Systems Parabolic Dish Project for FY 1983 are summarized. Included are discussions on designs of module development including concentrator, receiver, and power conversion subsystems together with a separate discussion of field tests, Small Community Experiment system development, and tests at the Parabolic Dish Test Site.

4559 (N—84-28223) Second Law efficiency of solar-thermal cavity receivers. Moynihan, P.I. (Jet Propulsion Lab., Pasadena, CA (USA)). Oct 1983. 61p. (NASA-CR—173732; JPL-PUBL—83-97). NTIS, PC A04/MF A01.

Properly quantified performance of a solar-thermal cavity receiver must not only account for the energy gains and losses as dictated by the First Law of thermodynamics, but it must also account for the quality of that energy. However, energy quality can only be determined from the Second Law. An equation for the Second Law efficiency of a cavity receiver is derived from the definition of available energy, which is a thermodynamic property that measures the maximum amount of work obtainable when a system is allowed to come into unrestrained equilibrium with the surrounding environment. The fundamental concepts of the entropy and availability of radiation were explored from which a workable relationship among the reflected cone half-angle, the insolation, and the concentrator geometric characteristics was developed as part of the derivation of the Second Law efficiency. First and Second Law efficiencies were compared for data collected from two receivers that were designed for different purposes. A Second Law approach to quantifying the performance of a solar-thermal cavity receiver lends greater insight into the total performance than does the conventional First Law method.

4560 (N—84-28225) Concentrator development. Owen, W.A. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

During the years of technology development by the Parabolic Dish program, the problems peculiar to tracking dishes have been explored in depth with particular emphasis on economics. Starting with the Precursor Concentrator, testing techniques and apparatus such as calorimeters and the flux mapper were developed. At the same time, mirrors were developed to have a long operating life as well as high performance. Commercially available equipment was evaluated as well. Building on all these elements, the Test Bed Concentrators were designed and built. With a peak intensity in the focal plane of over 17,500 suns and an average concentrator ratio over 3000 on an eight inch diameter aperture, they have proven to be the work horses of the technology. With a readily adjustable mirror array, they have proved to be an essential tool in the development of dish components, receivers, heat transport systems, instrumentation, controls, engines, and materials - all necessary to cost effective modules and plants. Utilizing the lessons learned from this technology, most cost effective systems were designed. These included Parabolic Dish Number 1 (PDC-1) and PDC-2 currently in final design by Acurex Corporation. Even more advanced concepts are being worked on, such as the Cassegranian systems by BDM Corporation.

4561 (N—84-28226) Parabolic Dish Concentrator (PDC-1). Dennison, E.W.; Argoud, M.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The design, construction, and installation of the Parabolic Dish Concentrator, Type 1 (PDC-1) has been one of the most significant JPL concentrator projects because of the knowledge gained about this type of concentrator and the development of design, testing, and analysis procedures which are applicable to all solar concentrator projects. The need for these procedures was more clearly understood during the testing period which started with the prototype panel evaluation and ended with the performance characterization of the completed concentrator. For each phase of the test program, practical test procedures were required and these procedures defined the mathematical analysis which was essential for successful concentrator development. The concentrator performance appears to be limited only by the distortions resulting from thermal gradients through the reflecting panels. Simple optical testing can be extremely effective, but comprehensive mechanical and optical analysis is essential for cost effective solar concentrator development.

4562 **(N—84-28227) Parabolic Dish Concentrator (PDC-2) development.** Rafinejad, D. (Acurex Corp., Morrisville, NC (USA)). Mar 1984. 9p. NTIS, PC A15/MF A01.

The design of the Parabolic Dish Concentrator (PDC-2) is described. The following five subsystems of the concentrator are discussed: (1) reflective surface subsystem, (2) support structure subsystem, (3) foundation, (4) drive subsystem, and (5) electrical and control subsystem. The status of the PDC-2 development project is assessed.

4563 **(N—84-28228) Transmittance-optimized, point-focus Fresnel lens solar concentrator.** Oneill, M.J. (Entech, Inc., Dallas-Fort Worth Airport, TX (USA)). Mar 1984. 13p. NTIS, PC A15/MF A01.

The development of a point-focus Fresnel lens solar concentrator for high-temperature solar thermal energy system applications is discussed. The concentrator utilizes a transmittance-optimized, short-focal-length, dome-shaped refractive Fresnel lens as the optical element. This concentrator combines both good optical performance and a large tolerance for manufacturing, deflection, and tracking errors. The conceptual design of an 11-meter diameter concentrator which should provide an overall collector efficiency of about 70% at an 815 C (1500 F) receiver operating temperature and a 1500X geometric concentration ratio (lens aperture area/receiver aperture area) was completed. Results of optical and thermal analyses of the collector, a discussion of manufacturing methods for making the large lens, and an update on the current status and future plans of the development program are included.

4564 **(N—84-28229) Optical analysis of Cassegrainian point focus concentrators.** Waterbury, S.S.; Schwinkendorf, W.E. (BDM Corp., Albuquerque, NM (USA)). Mar 1984. 9p. NTIS, PC A15/MF A01.

A Cassegrainian solar concentrator, using a 7-meter diameter primary reflector, was analyzed in three forms: (1) an unmodified Cassegrainian, (2) the Ritchey-Chretien configuration, and (3) the unmodified Cassegrainian with a non-imaging tertiary reflector. Optical performance was not significantly improved with the Ritchey-Chretien however, the tertiary resulted in significant improvement in intercept factor and optical efficiency. The effects of misalignment of the secondary and tertiary reflectors on the optical performance of the collector were also analyzed.

4565 **(N—84-28230) Current status of an organic Rankine cycle engine development program.** Barber, R.E. (Barber-Nichols Engineering Co., Arvada, CO (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The steps taken to achieve improved bearing life in the organic Rankine cycle (ORC) engine being developed for use on solar parabolic dishes are presented. A summary of test results is given. Dynamic tests on the machine shaft and rotors of the ORC engine are also discussed.

4566 **(N—84-28232) Advanced solar receivers.** Owen, W.A. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 7p. NTIS, PC A15/MF A01.

Low thermal efficiencies in solar receivers are discussed in terms of system design. It is recommended that careful attention be given to the overall thermal systems design, especially to conductive losses about the window and areas of relatively thin insulation. If the cavity design is carefully managed to insure a small, minimally reradiating aperture, the goal of a very high efficiency cavity receiver is a realistic one.

4567 **(N—84-28233) Solar tests of aperture plate materials for solar thermal dish collectors.** Jaffe, L.D. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 10p. NTIS, PC A15/MF A01.

If a malfunction occurs in a solar thermal point-focus distributed receiver power plant while a concentrator is pointed at the Sun, motion of the concentrator may stop. As the Sun moves relative to the Earth, the spot of concentrated sunlight then slowly walks off the receiver aperture, across the receiver face plate, and perhaps across adjacent portions of the concentrator. Intense local heating by the concentrated sunlight may damage or destroy these parts. The behavior of various materials under conditions simulating walk-off of a parabolic dish solar collector were evaluated. Each test consisted of exposure to concentrated sunlight at a peak flux density of about 7000 kW/square meter for 15 minutes. Types of materials tested included graphite, silicon carbide, silica, various silicates, alumina, zirconia, aluminum, copper, steel, and polytetrafluoroethylene. The only material that neither cracked nor melted was grade G-90 graphite. Grade CS graphite, a lower cost commercial grade, cracked half-way across, but did not fall apart. Both of these grades are medium-grain extruded graphites. A graphite cloth (graphitized polyacrylonitrile) showed fair performance when tested as a single thin ply it might be useful as a multi-ply assembly. High purity slipcast silica showed some promise also.

4568 **(N—84-28234) Non-DOE-sponsored domestic dish activities.** Fujita, T. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The parabolic dish development activities being undertaken within the private sector of the United States were addressed. The primary emphasis of these non-DOE-sponsored activities is the development of commercial products that can penetrate the market in the near term. The exchange of information between these activities and the complementary DOE-sponsored work directed toward developing advancements in technology is considered to be of major importance. The experiences and problems encountered in the private sector serve as inputs that will help guide in the planning of the DOE program. In turn, a principal objective of the DOE program is the transfer findings of its technological development activities to the private sector. Activities in the private are characterized by their diversity in terms of both product design and marketing approach. The differences in the design concepts and the sizes of the dish concentrators under development are particularly noteworthy.

4569 **(N—84-28237) Recent developments: PKI square dish for the Soleras Project.** Rogers, W.E. (Power Kinetics, Troy, NY (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The Square Dish solar collectors are subjected to rigorous design attention regarding corrosion at the site, and certification of the collector structure. The microprocessor controls and tracking mechanisms are improved in the areas of fail safe operations, durability, and low parasitic power requirements. Prototype testing demonstrates performance efficiency of approximately 72% at 730 F outlet temperature. Studies are conducted that include developing formal engineering design studies, developing formal engineering design drawing and fabrication details, establishing subcontracts for fabrication of major components, and developing a rigorous quality control system. The improved design is more cost effective to product and the extensive manuals developed for assembly and operation/maintenance result in faster field assembly and ease of operation.

4570 **(N—84-28238) Continuing research at Solar Steam, Incorporated.** Wood, D. (Solar Steam, Inc., Tacoma, WA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

The design and manufacture of two solar dish systems are discussed. A 30 foot diameter glass dish was designed, tested, and abandoned due to poor cost effectiveness during mass production. A 40 foot diameter glass dish that uses a single post wind abatement support carriage is under development.

4571 **(N—84-28252) Deployment of a secondary concentrator to increase the intercept factor of a dish with large slope errors.** Ortabasi, U.; Gray, E.; Ogallagher, J. (Queensland Univ., St. Lucia (Australia). Solar Energy Research Centre). Mar 1984. 9p. NTIS, PC A15/MF A01.

The testing of a hyperbolic trumpet non-imaging secondary concentrator with a parabolic dish having slope errors of about 10 mrad is reported. The trumpet, which has a concentration ratio of 2.1, increased the flux through a 141-mm focal aperture by 72%, with an efficiency of 96%, thus demonstrating its potential for use in tandem with cheap dishes having relatively large slope errors.

4572 **(N—84-28256) Rapid Test Bed Concentrator (TBC) alignment techniques.** Argoud, M.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 1p. NTIS, PC A15/MF A01.

A new, labor and cost saving method was developed to eliminate the procedure of covering all (220) mirrors and uncovering then one-by-one in sequence to adjust each to the focal plane. This latest method being used to align mirrors of a parabolic solar concentrator utilizes a computer-derived target of discreet images made up of individual mirror reflections on a plane in front of the intended, nominal, focal point. Incorporating this computer technique increases accuracy and gives potential to develop flux distributions required by different receiver designs.

4573 **(N—84-28258) Recent solar measurements results at the parabolic dish test site.** Ross, D.L. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 8p. NTIS, PC A15/MF A01.

After the Mexican volcanic eruptions of March 28, April 3 and 4, 1982, the question of its effect on insolation levels at the Parabolic Dish Test Site (PDTS) naturally arose. Clearly, the answer to the original question is that the Mexican volcanic explosion had a significant impact on energy and insolation levels at the PDTS and, furthermore, it has been quite long lasting. The first really significant decrease in energy and insolation levels occurred in June 1982 when the energy level decreased by 19.7% while the peak insolation levels went down by 4.0%. June of 1982 was also the first month (of 13 consecutive months) when peak insolation levels did not equal or exceed 1,000 W/sq m. Signs of a recovery from the effects of the volcanic explosion began to appear in May of 1983, when the energy level exceeded that of May 1981 as well as May 1982. It would appear that energy and insolation levels are improving at the PDTS, but have not quite reached normal or pre-volcanic levels. At this time the data would seem to suggest a return to normal energy and insolation levels will occur in the very near future.

4574 **(NBS-GCR—84-475) Measurement techniques for evaluating solar reflector materials.** Richmond, J.C. (National Bureau of Standards, Washington, DC (USA)). Sep 1984. Contract AI01-76PR06010. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85002194.

Solar reflector materials are used to concentrate the terrestrial solar irradiance on a solar receiver in order to increase the temperature of the working fluid in a solar energy system. To ensure acceptable performance and service life of the materials used in reflectors, data must be available prior to the design, construction and use of reflectors. These data must be generated by reliable measurement techniques. This report assesses the current state-of-the-art of technology associated with the manufacture and evaluation of solar reflector materials and includes an identification of numerous research needs and a bibliography of 124 relevant documents.

4575 **(NP—5900011) Survey of solar simulator test facilities and initial results of IEA round robin tests using solar simulators.** Ley, W. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). Dec 1979. 86p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85900011.

The International Energy Agency (IEA) in cooperation with a number of participating countries investigates and evaluates standard solar collector test methods for the determination of the thermal performance of flat-plate solar collectors on an international basis. The thermal efficiency of two water heating flat-plate solar collectors (Chamberlain and Commercial Solar Energy) was obtained indoors using solar simulators. Solar simulators show good promise to potentially provide test results that are both reproducible and correlate well to outdoor performance. The use of a solar simulator is particularly attractive for testing a collector because each parameter may be varied independently to determine the full range of performance characteristics. However, future work has to be focussed on the identification of the performance features of solar simulators, because the differences found in the initial results of IEA round robin tests seem to be strongly associated with the functional characteristics of the solar simulators which were not sufficiently evaluated at this interim phase of the program.

4576 **(NP—5900024) Results and analyses of IEA round robin testing. Task III. Performance testing of solar collectors.** (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). Dec 1979. 109p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85900024.

Two flat-plate collectors were subjected a round robin testing. Three procedures were applied to determine thermal performance. A total of 16 laboratories were engaged in the test. The testing facilities were situated in 12 different countries distributed over the northern hemisphere. The meteorological test conditions and systematic errors of the test facilities can fully account for the spread of round robin efficiency data. The most pronounced contribution to systematic deviation is caused by the pyranometer. None of the procedures proved to be superior with respect to the data scatter. The results from the applied procedures do compare very well.

4577 **(NP—5900105) Failure modes of solar collectors.** Pedersen, P.V. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Aug 1981. 197p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85900105.

This report contains a compilation and evaluation of 25 inspection reports on reliability and durability of solar collectors in existing solar energy systems. The reports are made by participants of the IEA Solar Heating and Cooling Programme, Task III, according to a format developed for this purpose. Different kinds of problems, changes and failures have been observed for all the inspected solar collectors. A presentation of the above with respect to collector part, problem area and influence from climate and surroundings is made.

4578 **(SAND—84-7011) Innovative solar thermal dish technology development.** Schwinkendorf, W.E. (BDM Corp., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 261p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85002787.

A Cassegrainian point focus solar concentrator system has been analyzed and a conceptual design developed. In this system, the receiver is located at the vertex of the primary mirror eliminating limitations of receiver size and weight associated with standard parabolic dish collectors. Disadvantages include increased reflection loss at the secondary mirror and increased beam spread associated with the longer focal length. A non-imaging, trumpet shaped tertiary reflector located at the receiver aperture increases the system efficiency by 15 to 20%. Because the secondary mirror may reach very high temperatures, a reflective film cannot be used as a mirror surface. Recommended instead is thin polished stainless steel stamped into shape and used as the mirror substrate with vacuum deposited silver used for the reflecting surface. A transparent coating is then required to protect the silver. Both the secondary and primary mirrors require radial supports on the back surface to minimize deflection under wind loading. The Cassegrainian system is more efficient than the standard dish only at high operation temperatures and for large receivers. However, the cost per kilowatt into the receiver aperture is less for the Cassegrainian, due primarily to the high cost of piping and insulation running to the receiver of the standard dish. Further efforts in the analysis and design of the Cassegrainian concept appear warranted.

4579 **(SERI/PR—255-2162) Active solar heating and cooling technology program: polymer stabilization research subtask. Gas phase fluorination of transparent polymer films. Progress report, October 1, 1982-September 30, 1983.** Jorgensen, G.J.; Schissel, P. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 29p. NTIS, PC A03/MF A01. File Number DE84013050.

A gas phase fluorination reactor system (GPFRS) has been designed, built, and utilized. This unit has allowed the surface fluorination of a wide variety of commercially available, transparent, polymeric films. The goal has been to provide a potentially inexpensive procedure for obtaining improved materials properties with initial emphasis on optical transmittance and weatherability.

4580 **(STU—80-5604) Optical selectivity of stainless steel oxides.** Ribbing, C.G. (Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Aug 1983. 29p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750226.

Optical properties of a number of stainless steels have been determined. Ferritic steels were somewhat better as absorbers. Thin films of Cr_2O_3, Fe_2O_3, Cu_2O and CuO have been investigated. It was shown that the optical properties of metal-oxide-metal tandems can be calculated from the value for pure oxides and pure metals. Five different oxidation methods have been tested. Steels coloured by the INCO method showed excellent absorption properties, having a low refractive index.

1420 Heat Storage

REFER ALSO TO CITATION(S) 1420004453, 4544, 4555

4581 **(CONF-8403146—5) Latent heat storage technology and application workshop. Summary report: Session VI.** Martin, J.F. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001097.

From IEA workshop on latent heat stores; Stuttgart, F.R. Germany (5 Mar 1984).

A brief account is given of Session VI, which was the summary session including general discussion and conclusions. (MHR)

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

4582 **(DOE/SF/11720—T1) Geothermal energy at Long Beach Naval Shipyard and Naval Station and at Seal Beach Naval Weapons Station, California. Final report.** Higgins, C.T.; Chapman, R.H. (California State Dept. of Conservation, Sacramento (USA). Div. of Mines and Geology). 1984. Contract AC03-83SF11720. 112p. NTIS, PC A06/MF A01. File Number DE85002493.

The purpose of this project was to determine and evaluate sources of geothermal energy at two military bases in southern California, the Long Beach Naval Shipyard and Naval Station and the Seal Beach Naval Weapons Station. One part of the project focused on the natural geothermal characteristics beneath the naval bases. Another part focused on the geothermal energy produced by oilfield operations on and adjacent to each base. Results of the study are presented here for the US Department of the Navy to use in its program to reduce its reliance on petrolem by the development of different sources of energy. The study was accomplished under a cooperative agreement between the US Department of Energy's San Francisco Operations Office and the Department of the Navy's Naval Weapons Center, China Lake, California, for joint research and development of geothermal energy at military installations.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 1503004582

4583 **(EUR—8731) Community demonstration project: geothermal doublet at Metanopoli Milan. Final drilling report.** (Commission of the European Communities, Luxembourg). 1983. 105p. (EUR—8731-EN). NTIS, PC E06/MF E06.

The objective of the Metanopoli project is the use of geothermal energy to heat homes and offices in an urban area of Milan. Preliminary studies showed the Ghiaie de Sergnano formation to be a promising aquifer in hydrogeological terms; details are given of the scope of its distribution, characteristics, temperature, and salinity. The aims of the Metanopoli I well are described. General details are given of the drilling of Metanopoli I and Metanopoli II wells together with production tests and their analysis. The total energy exploitable by the system is estimated to be around 850 tep/year.

4584 (ZfI-Mitt—80, pp 137-138) **Isotopic composition of sulfur and oxygen as an indicator of the development of ore-forming hydrothermal systems.** Zairi, N.M. (Tsentral'nyj Nauchno-Issledovatel'skij Gorno-Razvedochnyj Inst., Moscow (USSR)). Nov 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4585 (ZfI-Mitt—80, pp 62) **Complex isotope investigations of Armenian mineral waters.** Trettin, R.; Hiller, A. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Chalatjan, E.S. (AN Armyanskoj SSR, Erevan). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

1508 Geothermal Power Plants

4586 **(N—84-25596) Helical rotary screw expanders to generate electricity from geothermal brines.** (Jet Propulsion Lab., Pasadena, CA (USA)). Sep 1983. 2p. NTIS, PC A03/MF A01.

In nonaerospace uses of JPL technology, 18-19, N—84-25588 15-99.

A 1-megawatt, self-contained, helical rotary screw expander power plant to generate electricity of a geothermal brine wellhead was evaluated. The test support equipment, including a computer-controlled data system, an instrumentation and control van, and a 1000-kilowatt, variable bank were investigated. It was stated that the power was technically feasible although it operated at only about 45% average efficiency. Its technology transfer testing program involved Mexico, Italy, and New Zealand. The mineral laden geothermal brines of Mexico are more prone to scale formation than the Utah brine, and the power plant showed an increase in efficiency to a maximum of 62%.

1509 Geothermal Engineering

4587 **(DOE/SF/11537—1) Geothermal Elastomeric Materials Technology Application (GEM-TA) Program. Final report, August 1981-August 1983.** Hirasuna, A.R.; Davis, D.L.; Friese, G.J.; Trailer, J.W. (L'Garde, Inc., Newport Beach, CA (USA)). Aug 1984. Contract AC03-81SF11537. 119p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85003232.

In 1979, L'Garde, Inc. completed the development of several geothermal elastomer compounds. Major advances in the state of the art were achieved with successes at extreme conditions such as temperatures up to and exeeeding 320°C (608°F), pressures up to and exceeding 138 MPa (20,000 psi), and fluids ranging from brines to hydrocarbons. Because various geothermal projects had many elastomers problems and their solutions were critical to the project success, the DOE sponsored this effort to help provide the advantages of the earlier developed technology described above. The technology applications supported are as follows: pump lineshaft bearings; seals for Freon 114, synthetic hydrocarbon, and brine service; electrically insulative seals for logging tools; seals for nitrate salt explosive and steam service; and cementing wiper plugs. In addition there were minor efforts to further disseminate information associated with the elastomer development and case history experiences.

4588 **(PB—84-235399) Behaviour of a jointed geothermal reservoir.** Nicol, D.A.C.; White, A.A.L. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1984. 32p. NTIS, PC E04/MF E04.

The natural planes of weakness in crystalline rock are incorporated in a model of a 'hot dry rock' geothermal reservoir. Cold water injected at one borehole is constrained to flow through a two-dimensional network of intersecting fractures as it extracts heat from the rock en route to the production well. The temperature history of the outlet borehole is found for a number of fracture structures and borehole configurations and similarly the results of tracer injection experiments are predicted. In addition a method is described whereby the lifetime of a reservoir may be predicted directly from the field tracer experiments without the need to construct a particular model of the fluid flow paths through the reservoir. (Copyright (c) Central Electricity Generating Board, 1982.)

4589 **Hot dry rock geothermal energy program.** Smith, M.C. (Los Alamos National Lab., NM). *Interstate Oil Compact Commission Committee Bulletin;* 23: No. 2, 20-22(Dec 1981).

A description of a geothermal energy project in Fenton Hill, New Mexico, known as the Hot Dry Rock Program was presented. As opposed to common geothermal projects where existing hot ground water is trapped, this project utilized deep holes in dry rock. Two vertical holes were drilled and then connected by hydraulic fracturing. Water was pumped into the rock formation thru one hole, heated, and returned to the surface thru the other hole. The Fenton Hill Program was intended to yield water at 400°F and a total of 35 MW thermal energy. This would sustain 5-10MW of electricity generation.

17 WIND ENERGY

REFER ALSO TO CITATION(S) 1700004810

1706 Wind Energy Engineering

4590 **(BMFT-FB-T—84-154(Vol.1)) Operational behaviour of wind energy converters - control and dynamic - types of generators. Vol. 1.** Cramer, G.; Drews, P.; Grawunder, M.; Heier, S.; Kleinkauf, W.; Thuer, J.; Wettlaufer, R.; Albrecht, P.; Leonhard, W.; Vollstedt, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 308p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE84752278.

The dynamical behaviour of wind energy converters of various sizes has been investigated and control schemes as well as supervisory control structures have been developed. The work applies to isolated wind power stations and converters connected to a large grid. The possibilities of feeding power from a variable speed generator to a fixed frequency grid are a main object of the report. This includes double-fed induction generators with cycloconverters in the rotor circuit, permitting fast decoupled control of active and reactive power; induction generators with slip-power recovery and synchroneous generators with DC-link provide also fast active power control at reduced hardware cost. Measurements on laboratory equipment and existing installations serve as proof of the theoretical models. Some of the results have been used in the design stage of existing wind power equipment (e.g. GROWIAN I, AEROMAN, Windfarm Kythnos, DEBRA 100).

4591 **(BMFT-FB-T—84-155) Investigations on the dynamic loading of wind energy converters with vertical axis and problems of control during starting and overload conditions.** Duetting, S.; Helms, L.; Strackerjan, H.J.; Volk, K.H.; Simhan, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE84752277.

The report describes experimental and theoretical work towards the development of a Darrieus Rotor with straight blades, which without abandoning the usual fixed blade geometry has improved starting properties. The work has confirmed that by a proper choice of the blade profile and the converter geometry a selfstarting Darrieus wind converter can be realised. Further a brakesystem on the basis of an air spoiler stream which issues out of the support arms has been described, and this could serve to control the rotor at high speeds. Theoretical considerations show that the design of a converter with an appropriate performance characteristics and the correct dimensioning of the generator in conjunction with one another can enable the control of a gridgeared Darrieus converter under overload conditions almost solely through the generator. They also lead under windgeared operations to a reduced size of the brakesystem to be implemented. Finally a wind tunnel specially developed for wind converter experiments is described.

4592 **(DOE/NASA/20320—60) Aileron controls for wind turbine applications.** Miller, D.R.; Putoff, R.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1984. Contract AI01-76ET20320. 12p. (NASA-TM—86867; CONF-840804—53). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003043.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

Horizontal-axis wind turbines utilize partial or full variable blade pitch to regulate rotor speed. The weight and costs of these systems indicated a need for alternate methods of rotor control. Aileron-control is an alternative which has potential to meet this need. The NASA Lewis Research Center has been experimentally testing aileron-control rotors on the Mod-O wind turbine to determine their power regulation and shutdown characteristics. This paper presents experimental test results for a 20 and 38% chord aileron-control rotor. The test results to date show that aileron-control is a viable method for safely controlling rotor speed, following a loss of generator load.

4593 **(GKSS—84/E/16) Windpower operated seawater desalination plant at Hallig Suederoog.** Petersen, G.; Fries, S. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 37p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750261.

Within the framework of its research on water desalination and marine resources the GKSS Research Center at Geesthacht in cooperation with MAN Neue Technologie Muenchen has developed a wind powered reverse osmosis seawater desalination plant for the fresh water supply of the small island of Suederoog at the German coast of the North Sea. The plant has been successfully operated till the end of 1983. Suederoog is not connected to the public grid. The annual average windspeed is about 7 m/s and allows the production of up to 5,000 l of frewh water per day.

4594 **(LR—390) Investigation of the transition of laminar to turbulent flow at the boundary layer of the rotor blades of the 25 m HAT wind turbine.** van Groenewoud, G.J.H.; Boermans, L.M.M.; van Ingen, J.L. (Technische Hogeschool Delft (Netherlands). Afdeling der Luchtvaarten Ruimtevaarttechniek). May 1983. 40p. (In Dutch). ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

The aim of this investigation was to check if a wind turbine blade after two years of service was still smooth enough to facilate laminar flow. A second aim of this research was to investigate what surface finish demands and maintenance demands have to be made to facilate laminar flow. The results indicate that laminar flow is possible even without maintenance and that the measured transition point laminar-turbulent was in good agreement with the two-dimensional calculation method. (J.C.R.)

4595 **(N—84-28262) Description of two methods for calculation of low frequency wind turbine noise, including applications for the Swedish prototype Wind Energy Conversion System (WECS) Maglarp.** Meijer, S.; Lindblad, I. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden). Dept. of Aerodynamics). Dec 1983. 55p. (FFA-TN—1983-31). NTIS, PC A04/MF A01.

Computer programs to calculate the noise due to the passage of wind turbine blades through the wake of the tower of a downwind turbine, and to calculate the noise due to the steady loading of the blades (Gutin noise) are described. Results obtained from the programs are given with results from a program that calculates the

noise from the unsteady loads due to atmospheric turbulence. (ESA)

4596 **(N—84-28263) Dynamic behavior of wind turbines.** Ottens, H.H. (National Aerospace Lab., Amsterdam (Netherlands)). Aug 1983. 13p. (NLR-MP—83047-U). NTIS, PC A02/MF A01.

The dynamic response of wind turbines was calculated, and the dynamic stability was investigated. Methods to calculate the dynamic behavior are discussed. The analysis of the dynamic behavior produces the eigenfrequencies of the turbine construction as a function of the rotor speed in order to avoid eigenfrequencies coinciding with frequencies of exciting loads. The dynamic analysis also shows if the turbines motions are damped allowing the stability of the turbine design to be determined. (ESA)

4597 **(N—84-28264) Appraisal of straight bladed vertical and horizontal windmills.** Mcanulty, K.F. (Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (UK)). 1983. 9p. (PP—127). NTIS, PC A02/MF A01.

Vertical (VA) and horizontal axis (HA) windmills were compared in uniform wind and free air tests. Free air performance for both types is similar. The absence of yaw control mechanism is a significant factor in favor of the VA type. Pitch control over the entire blade allows both types to operate in high winds. Cyclic stall in high wind speeds makes extensive (whole blade) pitch control essential for VA machines, and incurs an unquantified penalty in terms of rotor complexity and tower head weight. There is no favored output shaft arrangement. The simple blade shape of VA machines should result in cost savings. The dynamic characteristics of VA machines are uncertain, in contrast to a well developed and validated analysis for the HA type. If light weight rotors can be built for VA machines (using advanced, high specific strength materials), their development to large sizes is attractive. (ESA)

4598 **(R—623-D/EMV83-31) Measurements on a diesel generator set for an autonomous wind diesel system.** de Bonte, J.; Breman, B.; Kraayvanger, T. (Technische Hogeschool Twente, Enschede (Netherlands). Afdeling Technische Natuurkunde). Nov 1983. 39p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Some measurements on a diesel generator set, which will be used in an autonomous wind diesel system, are described. Two kinds of measurements have been executed: measurement of the fuel consumption at constant and fluctuating load, and measurement of the stability of several control units. From the first measurements it appears that the fuel consumption does not increase at fluctuating load. From the second measurements it appeared that the standard electronical voltage control unit of the synchronous generator is not suitable for thyristor loads. It has to be replaced by another one. The diesel's governor gives a frequency resonance (3%) at a load fluctuating of about 1 Hz. (A.V.)

4599 **(SAND—84-2017C) Coherence in wind farm power harmonics.** Nellums, R.O. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 12p. (CONF-8409168—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002445.

From American Wind Energy Association conference; Pasadena, CA, USA (24 Sep 1984).

Individual wind turbine electrical output typically includes significant periodic content at multiples of the rotor rotational frequency. Qualitative field observations indicate groups of vertical or horizontal axis turbines in wind farms may assume frequency and phase synchrony of output fluctuation, with the result that individual turbine output fluctuations combine coherently. although no objectionable effects have been reported, potential for high wind farm power ripple resulting from coherent output harmonics is not well understood and is of concern. This paper presents a theoretical analysis of the mechanism for synchrony and reaches tentative conclusions as to the extent of the phenomenon, a subject to experimental verification.

4600 **(SERI/TP—214-2374) Observed acoustic and aeroelastic spectral responses of a MOD-2 turbine blade to turbulence excitation.** Kelley, N.D.; McKenna, H.E.; Jacobs, E.W. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1984. Contract AC02-83CH10093. 9p. (CONF-8405153—4). NTIS, PC A02. File Number DE84013012.

From Horizontal-axis wind turbine technology conference; Cleveland, OH, USA (8 May 1984).

Early results from a recent experiment designed to directly evaluate the aeroacoustic/elastic spectral responses of a MOD-2 turbine blade to turbulence-induced unsteady blade loads are discussed. The experimental procedure consisted of flying a hot-film anemometer from a tethered balloon in the turbine in-flow and simultaneously measuring the fluctuating airload and aeroelastic response at two blade span stations (65% and 87% spans) using surface-mounted, subminiature pressure transducers and standard strain gage instrumentation. The radiated acoustic pressure field was measured with a triad of very-low-frequency microphones placed at ground level, 1.5 rotor diameters upwind of the disk. Initial transfer function estimates for acoustic radiation, blade normal forces, flapwise acceleration/displacement, and chord/flapwise moments are presented.

4601 **Wind turbine generator interaction with diesel generators on an isolated power system.** Scott, G.W.; Wilreker, V.F. (Advanced Systems Technology, Westinghouse Electric Corporation, Pittsburgh, PA). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **PAS-103**: No. 5, 933-937(May 1984).

The Block Island Power Company (BIPCO), on Block Island, Rhode Island, operates an isolated electric power system consisting of diesel generation and an experimental wind turbine. The 150-kW wind turbine, designated MOD-OA by the U.S. Department of Energy is typically operated in parallel with two diesel generators to serve an average winter load of 350 kW. As part of an experimental program to evaluate wind turbine generator performance on the isolated diesel power system, the recordings from an extensive data measurement effort were reviewed and analyzed to define the nature of the dynamic interaction effects. The data were collected over a three-month period on the system to which the DOE/NASA experimental wind turbine was connected. During this time, the diesel units were lightly loaded resulting in up to 60% of the total load demand being supplied by the MOD-OA in periods of severely gusting winds. In three of the modes of normal MOD-OA operation -- startup synchronization, shutdown/cutout, and continuous fixed pitch running -power, frequency and voltage transients were comparable with those produced by typical load changes on the diesel system alone. In the fourth mode, variable pitch (constant power) control, a significant reduction in system damping sometimes occurred which gave rise to increased frequency and voltage perturbations under gusty wind conditions. Based on a linear model of the system it is shown that changes in control system settings could be made to improve damping. The main study conclusion is that wind turbine generation, even when providing a large portion of the power required by an isolated utility, can be a practical option resulting in system disturbances no greater than those found in conventional diesel systems.

4602 **Acoustic ranging technique for assessing low-frequency acoustic noise from wind turbines.** Kelley, N. (SERI, Golden, CO). *Wind Engineering;* **8**: No. 1, 19-20(1984).

An acoustic source ranging procedure is obviously a research tool and would not normally be attempted by an individual wind turbine owner. The minimum equipment necessary for the analysis includes three microphone systems preferably with very low-frequency response, an FFT dual-channel signal analyzer with hard copy or data output capability, and the necessary cabling. There is no requirement to record the acoustic data although it is certainly easier to post-process the data when all three microphone pairings can be analyzed from the same time record. If this is done, a suitable FM tape recorder with at least three tracks is required. Assessment of the degree of concentration of source region within a swept area is necessarily somewhat subjective. The time signal itself from one microphone should also be examined for periodic impulsiveness which would indicate a localization of source region.

This can be analyzed in parallel with blade position (abiding acoustic transport delays) to corroborate a source ranging location.

4603 **Status of Boeing wind-turbine systems.** Lowe, J.E.; Wiesner, W. (Boeing Engineering Company, Seattle, Washington). *IEE (Institution of Electrical Engineers) Proceedings, Part A: Physical Science; Measurement and Instrumentation; Management and Education; Reviews;* **130**: No. 6, 531-536(Dec 1983).

Boeing involvement with wind energy began in 1977 with the award of the US Department of Energy (DOE) sponsored MOD-2 programme to design, fabricate and install the first multimegawatt rated wind turbines developed for commercial operation. Five 2.5 MW MOD-2 turbines have been installed: three at Goldendale, Washington, one at Medicine Bow, Wyoming and in Solano County, California. These five units have operated on-line for over 4200 hours and generated over five-million kilowatt-hours of energy. The DOE MOD-5B programme to design, fabricate and install a third generation multimegawatt machine was awarded to Boeing in 1980. The MOD-5B incorporates the operational and test experience obtained with the MOD-2 test wind turbines as a great many performance improvements. These items, coupled with a continuing effort of design simplification, combine to give a wind turbine which will be highly reliable and meet the economic objectives of electric utility customers. This paper presents a summary of experiences to date with the MOD-2 machines, and the current status of the MOD-5B design.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 2001004171, 4413, 4414, 4415, 4416, 4417, 4422, 4423, 4424, 4428, 4429, 4430, 4431, 4432, 4433, 4433, 4434, 4434, 4435, 4435, 4436, 4437, 4437, 4621, 4780, 4793, 4801, 5098

4604 **(ANL/EES-TM—250) Economic potential for converting utility boilers to coal combustion.** Streets, D.G.; Grogan, P.J.; Hanson, D.A. (Argonne National Lab., IL (USA)). Feb 1983. Contract W-31-109-ENG-38. 109p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85002609.

The methodology used in this analysis to determine the economics of utility boiler conversions is similar to approaches used in modeling utility decision making. The functions of the three analytic modules are as follows: Environmental module - Calculates historic emissions of SO_2 and particulate matter on the basis of plant-specific fuel-use data. Projects emissions after conversion on the basis of size-specific SIP limits at the state level. Cost module - Calculates new boiler costs and environmental control costs at the plant level. Calculates conversion costs for three classes of utility boilers. Passes cost data to the financial module for analysis of the conversion decision. Financial module - Calculates the cost per kilowatt-hour of electricity generated for each scenario. Incorporates a risk premium for coal-fired boilers and FGD units. Evaluates the conversion decision at the plant level, either on the basis of least-cost alternative (deterministic solution) or a distribution of outcomes based on relative cost differential (probabilistic solution).

4605 **(BMFT-FB-T—84-141) Technical and economic comparison of application of battery energy storage plants for peak shaving in distribution networks.** Seele, W.; Adler, T.; Gels, H.B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 260p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE84752271.

Objective of the study is to deduce secured statements on the application of battery energy storage plants (BESP) with sodium-sulphur-high energy batteries for peak shaving in distribution networks. The study includes a summary of requirements on such plants, the BESP overall design in the power range of 1 MW to 100 MW, and the examination of its application in real distribution networks of public utilities and industrial works. The results of the study demonstrate the possibility of BESP application for peak shaving in a technical and economic view. Of great importance are the BESP costs, especially the battery costs, the reliable BESP operation, the daily load curves of the user and the scale of prices for the received electrical energy.

4606 **(DOE/METC—84-10, pp 141-149) Use of computers in the development and integration of advanced technology fossil power cycles.** Weinstein, R.E. (Gilbert/Commonwealth, Reading, PA). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Evaluations of the cost and performance of future fossil energy power cycles will require the application of practical engineering experience coupled with the innovative application of computer models. The need frequently develops for the projection of the expected performance of power conversion devices that have characteristics as yet not clearly defined. The evaluation process under these circumstance requires both technical and economic feasibility studies. These studies are most effectively performed by combining the skills of engineers expert in advanced concept cycle integrations with those of plant designers and cost engineers. Effective computer modeling and simulation provide tools for such project teams, having the flexibility to quickly and simply evaluate the effects caused by changes in design criteria, technology or operational scenarios. This paper describes the considerations and approaches that must be made for the effective computerized evaluation of advanced energy projects as they evolve from the idea stages to conceptual designs. The approaches presented are applicable to all power cycles, and are illustrated by examples from cycle evaluations of fuel cells integrated, coal gasification combined cycles, magnetohydrodynamics, pressurized fluidized bed systems, and boiler retrofits from oil to coal/water mixtures. 2 figures.

4607 **(DOE/METC—84-10, pp 252-261) Development of a computer assisted cost/benefit procedure for the analysis of retrofit industrial boilers.** Berg, R.D.; Antonovich, M.P. (Gilbert Associates, Inc., Reading, PA). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The Fossil Energy Division of the Department of Energy is working to advance retrofit of existing oil-fired boilers to coal combustion systems. As part of this effort, Gilbert/Commonwealth developed and computerized a cost/benefit procedure for comparing advanced coal-fired combustion systems. All of the evaluations were analytical, and were based on conceptual designs derived from experience with conventional industrial boilers and previous evaluations of utility boilers. For the purposes of this study, three baseline boiler plant configurations were identified. Both field erected and package boilers were evaluated for each baseline boiler plant. Both technical and economic evaluations were performed for each plant configuration/fuel combination. The boilers were modeled to establish performance parameters for operation with each alternate fuel. System layouts were prepared for each plant/fuel pairing. Computer modeling techniques were then used to obtain mass and heat balances for each boiler system and computer-generated schematic diagrams prepared for each plant/fuel configuration. Economic evaluations were made by obtaining capital and O and M costs for the plants as defined in the system schematics. Cost algorithms were then generated for each plant/fuel combination using the results of the cost estimates. Using these algorithms, a methodology for calculating the cost of steam produced was established. Cost of steam calculations were then used as the starting point for a cost/benefit procedure to compare and evaluate boiler conversion economics. Finally, the cost/benefit procedure was transcribed for both microprocessor and mainframe computer utilization.

4608 **(DOE/METC—84-10, pp 312-317) SALTD dynamic systems code.** Berry, G.; Geyer, H. (Argonne National Lab., IL). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

A dynamic systems code has been developed for the dynamic analysis of power plants. The code has been used to analyze power plant transients and determine control system design specifications. The SALTD code is an enhancement to the SALT systems code, which was also developed at ANL. The code has numerous features that make it more usable than similar dynamics systems codes based on the CSMP concept. The SALTD code contains two distinct steady state finder methods. The code can either solve the dynamic equations (with derivatives set to zero), using a sophisticated nonlinear N-dimensional equation solver, or it can use a fast integration scheme to determine the steady-state solution. The code also uses precompiled models, which allows the system to be set up much more easily and does not waste valuable computer time to sort and recompile every single model (as is customary in many dynamic systems codes). This feature is very helpful in a design situation or an R and D environment, where the system configuration and design parameters are subject to change. Finally, the integration algorithm is an enhancement to the GEAR package, which also solves nonlinear algebraic equations and takes into account the sparsity in the Jacobian (this leads to a quicker redetermination of the Jacobian and its inverse). 9 references.

4609 **(DOE/NASA/0017—3) Manual of phosphoric acid fuel cell power plant optimization model and computer program.** Lu, C.; Alkasab, K.A. (Cleveland State Univ., OH (USA)). May 1984. Contract AI21-80ET17088. 64p. (NASA/CR—174721). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000443.

An optimized cost and performance model for a phosphoric acid fuel cell powerplant system has been derived and developed into a modular FORTRAN computer code. The mathematical model developed in this study combines appropriate cost, energy, and electrochemical analysis as applied to the major components of a phosphoric acid fuel cell system. In the model, the following important parameters were optimized: steam to methane ratio in the reformer, hydrogen utilization in the fuel cell stack, and the number of fuel cell plates per stack. The optimization technique used here was by means of COMPUTE code which was developed for solving nonlinear programming problems.

4610 **(NP—5770009) Reliability investigations of the annual planning of power plant operation.** Danda, R. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 14 Jul 1982. 128p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770009.

A mathematical method for establishing the reliability of power plant systems within annual power-plant operation planning was developed. The effects of simplifications can be covered by a Monte-Carlo Simulation model. The field of application covers also the evaluation of maintenance schedules and those of energy supply and energy purchase and extension planning. The calculation method proves its value for quantifying deviations in system reliability between different maintenance schedules and reserve contracts.

4611 **(NP—5770011) Heat transfer with film cooling of gas-turbine combustion chambers.** Wahl, D. (Stuttgart Univ. (Germany, F.R.)). 18 May 1983. 149p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770011.

A multi-layer integral process was developed by means of the velocity and temperature profiles measured in the model of the flame-tube wall, the Prandtle mixture path approach and by means of approaches to thickness development of the temperature layer. A prediction can be made concerning wall temperatures near the injection site. Improvement of cooling effect is correlated with the decrease of the temperature ratio of cooling air to hot gas.

4612 **(NP—5770012) Optimum control of steam powerstation units, taking non-stationary thermal stresses into account.** Oellig, W. (Stuttgart Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik und Dampfkesselwesen). 25 Feb 1983. 163p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770012.

By using digital systems for process control, an optimum regulator for minimizing stationary heat stresses was designed and tested for the example of unit 5 at the Pfaffenwald (Stuttgart) heating powerstation. A model of the pipewall temperature was produced as a design aid, by which mean pipewall temperature differences and therefore thermal stresses proportional to these can be easily detected and assessed as control quality criteria. The results of simulation obtained make the capabilities of the optimum control process clear. The experimental comparison with conventional control also showed the clear superiority of the optimum control concept. The results show that the optimum control process is very suitable for application in powerstation technology.

4613 **(NP—5770021) Investigation into power plant reserves required for daily operation.** Schaeper, W. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 29 Jun 1982. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770021.

Outages of power plant units and uncertainty of day-load forecasts are the factors to be accounted for with the reserve requirements of the daily-power-plant-operation planning studied. Unit behaviour was calculated with a view to the cyclical application mode of medium-load and peak-load units resulting in an increased operational probability. The effect of uncertainty of forecasts, of maximum unit output and of reserve support within the interconnected system were studied.

4614 **(NP—5770026) Contribution to vibration behaviour of closely coupled blade systems.** Jarosch, J. (Stuttgart Univ. (Germany, F.R.). Fakultaet 5 - Energietechnik). 14 Jun 1983. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770026.

Because of the large number of parameters involved, it has not so far been possible, except for a few special cases, to predetermine the natural frequency of closely coupled blade systems. This thesis shows that the methods developed in aircraft gas turbine construction to describe the vibration behaviour of blades with elastic wheel discs can be used for closely coupled blade systems with rigid rotors. Starting from the vibration properties of the circular disc, one moves via the bladed elastic disc to coupled blades on rigid rotors. Instead of being the initial point, the free-standing blade becomes the limiting case, which represents a minimum of coupling. Vibration, which is usually regarded as complex and manifold, can thus be classified into a few groups with specific properties and can be qualitatively predicted to a certain extent. Long term experiments on the example of a bound industrial turbine final stage, where the blades with plug-in feet are connected in a nearly ideal way with the rotor machined from solid, show that vibration can be described by the terminology derived from the bladed elastic disc. In this way measurements at the same final stage can be classified and interpreted..

4615 **(UCRL—88409) Numerical modeling techniques for half-space (ground) problems.** Miller, E.K.; Burke, G.J.; King, R.J.; Mathur, N.C. (Lawrence Livermore National Lab., CA (USA); Illinois Univ., Chicago (USA)). 19 Jul 1983. Contract W-7405-ENG-48. 35p. (CONF-8310167—4). NTIS, PC A03. File Number DE85001053.

From NATO-AGARD lecture series number 131; Ankara, Turkey (19 Oct 1983).

In the frequency range below a few hundred MHz, the earth-air interface can significantly affect the EM characteristics of a nearby object. The characteristics most likely to be affected are: (1) the object's current distribution and input impedance (if an antenna); and (2) the near and far fields that it produces. The problem of modeling both the object-ground near-field interaction and the ground screens used to reduce or control this interaction is discussed here. The basic model (Part I) employed for the object-ground interaction uses a thin wire approximation to the electric-field integral equation in which the kernel includes the interface effect via the usual Sommerfeld integrals. Both the reflected and transmitted fields are accounted for so that objects on both sides of the interface, or even penetrating the interface, can be modeled. Another approach (Part II) to modeling a ground system uses the surface impedance Z/sub s/ to represent the boundary conditions at the interface. To permit applications to a generic set of problems, Z/sub s/(rho) is permitted to vary arbitrarily in the radial direction. A one-dimensional integral equation is first used to solve for the

tangential magnetic field on the interface. This field is then used in a two-dimensional integral to find the radiation patterns for arrays of vertical dipoles over ground screens. The analytical development and numerical treatment of each approach are summarized, and numerous examples are given to illustrate the results that can be obtained.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 2002004198, 4211

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 2003004610, 4613, 5305, 5362, 5363, 5364, 5365, 5366, 5367, 5368, 5369, 5370, 5371, 5372, 5373, 5374, 5375, 5376, 5377, 5378, 5379, 5380, 5381, 5382, 5383, 5384, 5385, 5386, 5387, 5388, 5443, 5460, 5557, 5558

4616 (EPRI-EL—3581, pp 7.19-7.31) **Statistical survey of PCB contamination in substation and distribution system equipment containing mineral oil.** Saperstein, M.D.; Faeder, E.J. (Southern California Edison Co., Rosemead). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Electric utility substation and distribution equipment containing mineral oil can be contaminated with polychlorinated biphenyls (PCB). This contamination may occur during the manufacturing of the equipment, or during service and repair if PCB contaminated materials and equipment are used. Three sampling programs have been conducted to examine the extent of PCB contamination in a large electric utility company's substation and distribution system equipment. The specific goals of each survey and the sampling techniques used were somewhat different. Due to these differences, the extrapolation of sample results to estimate contamination on the entire system is limited in some respect. However, all three surveys give consistent results indicating that only about 3 to 6% of mineral oil equipment is contaminated with PCB above the 50 ppm level. The mean PCB concentration in distribution system transformers was approximately 8 ppm and the median level of contamination was less than 2 ppm. The mean PCB concentration in substation equipment was approximately 12 ppm with a median level of contamination of 2 ppm.

4617 (EPRI-EL—3581, pp 7.33-7.38) **Transformer risk assessment and option analysis.** Herbert, P.R. (High Voltage Maintenance Corp., Mentor, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

A Transformer Risk Assessment and Option Analysis Program in the first step in developing an action plan to cope with the potential problems involved with the ownership and operation of PCB or PCB contaminated transformers. Implementation of an inspection program utilizing the check list approach will provide an objective viewpoint as to the relative degree of risk with each individual transformer in an Electrical Distribution System. Action priorities can then be developed to expediently implement a practical and economical approach to minimize PCB transformer liabilities.

4618 (EPRI-EL—3581, pp 7.39-7.47) **Sunohio PCB detoxification experience.** Kozak, M.J. (Sunohio, Canton, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The Sunohio process for PCB detoxification is described. Four key areas in the process are considered, i.e., quality, operational efficiency, environmental compatibility, and reclassification capabilities. The Sunohio process produces a decontaminated mineral oil of such quality that it can instantly be reused in high voltage power equipment.

4619 (EPRI-EL—3581, pp 7.49-7.54) **Design of a fixed PCB storage facility to produce the most value for cleaned oil.** Centofanti, L. (PPM, Inc., Tucker, GA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The facilities and capabilities of PPM, Inc. in PCB decontamination are described. The disposal economics and on-site disposal of PCB-contaminated wastes are discussed. The design of a fixed PCB storage facility is described.

4620 (NP—5770022) **Dynamic simulation of power supply systems.** Grebe, E. (Dortmund Univ. (Germany, F.R.). Abt. Elektrotechnik). 21 Dec 1982. 171p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770022.

The behaviour of networks including power plant units was simulated for transition from interconnected-system operation to isolated-system operation with concomitant cessation of export supply. For the development of a turbine controller, a strategy was developed combining the advantages of direct output control for interconnected-system operation with the advantages of indirect output control of isolated-system operation. Studies benefited from application of medium-term models.

4621 (NP—5770025) **Economic importance of stochastic reserve demand in powerstation systems.** Stender, K. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Elektrotechnik). 22 Jun 1982. 133p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770025.

The use of powerstation systems for electricity generation and supply is affected by the occurrence of reserve demand. The amount of the reserve demand is determined by deterministic processes (e.g. by overhaul of units) and by stochastic processes (e.g. failure of units, under-estimates of load). The stochastic occurrence of reserve demand in existing powerstation systems is examined. First, there is a survey of economic assessment of powerstation priority. Then the deterministic-stochastic operation is divided into stages by means of a simulation model, in order to create the basis for the relationship between economy and reliability. Finally, there is an assessment of the results of the investigation.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 2100005226

4622 (NUREG—0020-Vol.8-No.9) **Licensed operating reactors. Status summary report, data as of August 31, 1983. Volume 8, No. 9.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Oct 1984. 414p. NTIS, PC A18/MF A01 - GPO*. File Number TI85900222.

This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 2101004359, 4629, 4671, 4685, 4712, 4717, 4719, 4722, 4733, 4735, 4736, 4737, 4738, 4748, 4749, 4750, 4759

4623 (FEI—1488) **Stability of the flow constant components in a system of channels coupled by manifolds and in a closed circuit.** Yarkin, A.N.; Kulikov, B.I.; Shvidchenko, G.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703281.

The coolant stability in steam-generating channel systems and in a closed circuit is considered. The system of two identical steam-generating channels with common input and output collectors is investigated. The following parameters are specified: mean pressure, specific heat flux, inlet coolant temperature and coolant total flow rate. Under these conditions the following states of the system are possible: the steady regime with channel equal and unequal stationary flow rates as well as self-oscillatory operation with interchannel pulsations of parameters. The equation describing the pressure drop dependence on the coolant flow rate is solved graphically. The system behaviour is explained by example of one-dimensional homogeneous flow model with the phase slip (steam and fluid). The dynamics of heat-mass transfer processes is described by differential equations of conservation of energy, mass and momentum. Possibilities of attaining the coolant flow rate stability for different values of operation parameters are determined. Investigated also is the system of a certain set of parallel identical steam-generating channels and a non heated by-pass channel.

4624 **(NUREG/CR—3715) Design, construction, and testing of a 2000°C furnace and fission product collection system.** Osborne, M.F.; Collins, J.L.; Lorenz, R.A.; Travis, J.R.; Webster, C.S. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 59p. (ORNL/TM—9135). NTIS, PC A04/MF A01 - GPO. File Number TI85002251.

An induction furnace, capable of operation at 2000°C in steam, was developed to conduct product release tests. The test specimen and steam atmosphere are contained in a stabilized ZrO_2 furnace tube, which is heated by a concentric susceptor of either tungsten or graphite. A two-color optical pyrometer and high-temperature thermocouples are used for temperature measurement. The furnace has operated reliably for periods up to 30 min at test temperatures of 1400 to 2000°C with steam flowing at ~ 1 L/min. The apparatus for collecting the released fission products includes a TGT, an aerosol deposition sampler, a series of glass fiber filters, and heated charcoal. A steam condenser and cooled charcoal, for inert gas adsorption, are located further downstream. The principal analytical techniques used for fission product identification and measurement are: (1) gamma spectroscopy, for all radionuclides on all test components; (2) spark-source mass spectrometry, for all elements, primarily deposits on the thermal gradient tube and filters; and (3) neutron activation, for iodine on selected test components. 16 references, 26 figures, 7 tables.

4625 **The emerging technology of synthetic aperture focusing for ultrasonic testing.** Busse, L.J.; Collins, H.D.; Doctor, S.R. (Pacific Northwest Laboratory (PNL), Battelle Memorial Institute, Richland, Washington). *American Society of Mechanical Engineers, [Paper]*; 84-PVP-122: 6(Jun 1984). (CONF-840647—).

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

The capabilities of synthetic aperture focusing techniques for ultrasonic testing (SAFT-UT) as a nondestructure testing technique are presented. SAFT-UT is a digital ultrasonic imaging method, which can be adapted to many different materials, specimen geometries, and wave propagation modes. The process allows each point within the inspected volume to be focused upon by mathematically simulating the action of a lens, specifically formed for imaging that point in the volume. All points are therefore imaged at the maximum available resolution. The PNL effort in SAFT-UT is a continuation of a program started earlier by the NRC at the University of Michigan. The objectives of the present program are: (1) to engineer and evaluate a real-time flaw detection and imaging system based on SAFT-UT for inservice inspection of all required LWR components, (2) to establish calibration and field test procedures, (3) to demonstrate and validate the system through field reactor inspections, and (4) to gain ASME Code acceptance of the real-time SAFT-UT technique. The following aspects of SAFT-UT are presented in this paper: (1) brief overview of SAFT imaging theory, (2) results demonstrating achievable lateral resolution, and (3) presentation of shear wave SAFT-UT images.

4626 **Dynamic computer simulation of the Fort St. Vrain steam turbines.** Conklin, J.C. (Oak Ridge National Lab., Oak Ridge, TN 37830). pp 15.01-15.15 of Proceedings of the fifth power plant dynamics, control and testing symposium. Vol. 1. Upadhyaya, B.R. Knoxville, TN, USA; The University of Tennessee (1983). (CONF-830318—).

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

A computer simulation is described for the dynamic response of the Fort St. Vrain nuclear reactor regenerative intermediate- and low-pressure steam turbines. The fundamental computer modeling assumptions for the turbines and feedwater heaters are developed. A turbine heat balance specifying steam and feedwater conditions at a given generator load and the volumes of the feedwater heaters are all that are necessary as descriptive input parameters. Actual plant data for a generator load reduction from 100 to 50% power (which occurred as part of a plant transient on November 9, 1981) are compared with computer-generated predictions, with reasonably good agreement.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 2102004359, 4623, 4624, 4625, 4670, 4671, 4673, 4683, 4686, 4694, 4695, 4723, 4724, 4725, 4726, 4727, 4728, 4731, 4732, 4734, 4737, 4745, 4748, 4749, 4750, 4756, 4759, 4963, 5104

4627 **(CONF-841017—2) Modeling and diagnostic techniques applicable to the analysis of pressure noise in pressurized water reactors and pressure-sensing systems.** Mullens, J.A.; Thie, J.A. (Oak Ridge National Lab., TN (USA); Analysis and Measurement Services, Knoxville, TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002474.

From Specialists' meeting on reactor noise - SMORN IV; Dijon, France (15 Oct 1984).

Pressure noise data from a PWR are interpreted by means of a computer-implemented model. The model's parameters, namely hydraulic impedances and noise sources, are either calculated or deduced from fits to data. Its accuracy is encouraging and raises the possibility of diagnostic assistance for nuclear plant monitoring. A number of specific applications of pressure noise in the primary system of a PWR and in a pressure sensing system are suggested.

4628 **(CONF-841017—5) Contribution of fuel vibrations to ex-core neutron noise during the first and second fuel cycles of the Sequoyah-1 pressurized water reactor.** Sweeney, F.J.; March-Leuba, J.; Smith, C.M. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002317.

From Specialists' meeting on reactor noise - SMORN IV; Dijon, France (15 Oct 1984).

Noise measurements were performed during the first and second fuel cycles of the Sequoyah-1 pressurized water reactor (PWR) to observe long-term changes in the ex-core neutron signatures. Increases in the ex-core neutron noise amplitude were observed throughout the 0.1- to 50.0-Hz range. In-core noise measurements indicate that fuel assembly vibrations contribute significantly to the ex-core neutron noise at nearly all frequencies in this range, probably due to mechanical or acoustic coupling with other vibrating internal structures. Space-dependent kinetics calculations show that ex-core neutron noise induced by fixed-amplitude fuel assembly vibrations will increase over a fuel cycle because of soluble boron and fuel concentration changes associated with burnup. These reactivity effects can also lead to 180° phase shifts between cross-core detectors. We concluded that it may be difficult to separate the changes in neutron noise due to attenuation (shielding) effects of structural vibrations from changes due to reactivity effects of fuel assembly motion on the basis of neutron noise amplitude or phase information. Amplitudes of core support barrel vibrations inferred from ex-core neutron noise measurements using calculated scale factors are likely to have a high degree of uncertainty, since these scale factors usually do not account for neutron noise generated by fuel assembly vibrations. Modifications in fuel management or

design may also lead to altered neutron noise signature behavior over a fuel cycle.

4629 **(FRP—81/12) Development of a crack monitoring technique for use in a corrosion fatigue study of SA533-B pressure vessel steel.** Benson, J.M.; Tait, R.B.; Garrett, G.G. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Metallurgy). Oct 1981. 56p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85780200.

At present there does not exist a realistic crack growth law which will provide a good description of the relationship between the alternating stress intensity factor and the crack growth per cycle of stress. Such a law should be applicable to either the pressurized water reactor environment (PWR) or boiling water reactor environmnt (BWR). This project was formulated with the aim of examining the fatigue crack growth rate of SA533-B steel (a nuclear pressure vessel steel) in the threshold region in a simulated PWR environment. The aim of this report is to develop a crack monitoring technique for use in corrosion fatigue studies. Factors affecting fatigue crack propagation include: frequency, stress range, the effect of irradiation, ageing and environment. The mechanisms of crack propagation that are discussed include: slip dissolution, hydrogen assisted cracking, corrosion potential, and morphology studies. D.C. electrical potential, the compliance technique and the back-faced strain gauge method can be used for crack monitoring. Details are also given on the experimental equipment and programme. The results of the experiment has shown that the potential difference technique for monitoring crack length is a valuable one and is well suited for use in fatigue testing applications.

4630 **(HEDL-SA—3098-FP) Solid-state track recorder neutron dosimetry in light water reactor pressure vessel surveillance mockups.** Ruddy, F.H.; Roberts, J.H.; Gold, R.; Preston, C.C. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 15p. (CONF-840902—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001060.

From 5. ASTM-Euratom symposium on reactor dosimetry; Geesthacht, F.R. Germany (24 Sep 1984).

Solid-State Track Recorder (SSTR) measurements of neutron-induced fission rates have been made in several pressure vessel mockup facilities as part of the US Nuclear Regulatory Commission's (NRC) Light Water Reactor Pressure Vessel Surveillance Dosimetry Improvement Program (LWR-PV-SDIP). The results of extensive physics-dosimetry measurements made at the Pool Critical Assembly (PCA) at Oak Ridge National Laboratory (ORNL) in Oak Ridge, TN are summarized. Included are ^{235}U, ^{238}U, ^{237}Np and ^{232}Th fission rates in the PCA 12/13, 8/7, and 4/12 SSC configurations. Additional low power measurements have been made in an engineering mockup at the VENUS critical assembly at CEN-SCK, Mol, Belgium. ^{237}Np and ^{238}U fission rates were made at selected locations in the VENUS mockup, which models the in-core and near-core regions of a pressurized water reactor (PWR). Absolute core power measurements were made at VENUS by exposing solid-state track recorders (SSTRs) to polished fuel pellets within in-core fuel pins. 8 references, 4 figures, 10 tables.

4631 (IHZ-WK—81-380, pp 122-134) **Studies on power noise of PWR type reactors.** Meyer, K. (Ingenieurhochschule Zittau (German Democratic Republic)). 1982. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780209. (CONF-8205180—Pt.2).

From 6. scientific conference on power economy; Zittau, German D.R. (11 May 1982).

For evaluating noise measurements of neutron flux in power reactors position-dependent effects are taken into account. Based on an effective one-group diffusion model results are obtained for reactor noise due to vibrating fuel assemblies and fluctuations of neutron flux densities.

4632 (IHZ-WK—81-380, pp 164-174) **Application of the two-group method to transport perturbations.** Ulitzsch, D. (Ingenieurhochschule Zittau (German Democratic Republic)). 1982. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780209. (CONF-8205180—Pt.2).

From 6. scientific conference on power economy; Zittau, German D.R. (11 May 1982).

In PWR type reactors fluctuations of the coolant temperature inlet temperature lead to fluctuations of the neutron flux. The two group method is used for calculating spectral densities of these neutron flux fluctuations due to transport perturbations.

4633 **(JAERI-M—83-081) Abnormal transient analysis by using PWR plant simulator, (2). Secondary system analysis.** Naitoh, Akira; Murakami, Yoshimitsu; Yokobayashi, Masao. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 103p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE84703285.

This report describes results of abnormal transient analysis by using a PWR plant simulator. The simulator is based on an existing 822MWe power plant with 3 loops, and designed to cover wide range of plant operation from cold shutdown to full power at EOL. In the simulator, malfunctions are provided for abnormal conditions of equipment failures, and in this report, 17 malfunctions for secondary system and 4 malfunctions for nuclear instrumentation systems were simulated. The abnormal conditions are turbine and generator trip, failure of condenser, feedwater system and valve and detector failures of pressure and water level. Furthermore, failure of nuclear instrumentations are involved such as source range channel, intermediate range channel and audio counter. Transient behaviors caused by added malfunctions were reasonable and detail information of dynamic characteristics for turbine-condenser system were obtained.

4634 **(JAERI-M—83-097) Loss-of-load transient calculations for the ROSA-IV LSTF and the reference PWR with RELAP5/MOD1(Cycle 1).** Fineman, C.P.; Tanaka, Mitsugu; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703289.

The response of LSTF and the reference PWR to two loss-of-load transients was analyzed with the RELAP5/MOD1, Cycle 1, computer program. The transients analyzed included a loss-of-load only (base case) and a loss-of-load without scram. These calculations were the first attempt to analyze the response of LSTF to a loss-of-load transient and, therefore, are not a final assessment of the system's capability to represent the PWR response. Comparison of the results showed that LSTF has the capability to simulate the basic PWR response to a loss-of-load. For both transients calculated, the final state of LSTF and the PWR were the same, in that the primary systems had stabilized and were maintained in that condition by the same type of secondary system operation. Because of differences in initial core power and primary flow rate, however, the details of the thermal-hydraulic response (such as the system pressure and temperature) were different. Further study and analysis of the problem areas are recommended in order to find ways to improve the LSTF response relative to the PWR.

4635 **Licensing process at Diablo Canyon nuclear powerplant. Oversight Hearing before the Subcommittee on Energy and the Environment of the Committee on Interior and Insular Affairs, House of Representatives, Ninety-Eight Congress, Second Session, January 24, 1984.** Washington, DC, USA; Government Printing Office (1984). 221p.

Management incompetence and design errors at the Diablo Canyon have led to a failure in both quality assurance and quality control that are delaying licensing procedures. A hearing on the safety of this reactor brought testimony on the dangers of nuclear power plants that must be balanced with the danger of inadequate energy supplies. Nunzio Palladino, Chairman of the Nuclear Regulatory Commission (NRC) discussed the status of the Diablo design and construction and NRC's efforts to evaluate allegations. Other testimony by the remaining Commissioners and representatives of public interest groups and the State of California addresses this issue. Statements by the commissioners at a briefing on Diablo Canyon construction and regulation and two appendices with additional material for the record follow the testimony.

4636 Theoretical and experimental stochastic modeling analysis of PWR core heat transfer. Upadhyaya, B.R.; Sweeney, F.J. (Dept. of Nuclear Engineering, Univ. of Tennessee, Knoxville, TN 37996-2300). pp 46.01-46.20 of Proceedings of the fifth power plant dynamics, control and testing symposium. Vol. 2. Upadhyaya, B.R. Knoxville, TN, USA; The University of Tennessee (1983). (CONF-830318—).

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

A multi-nodal stochastic heat transfer model has been developed to study the fuel-to-coolant heat transfer and the effects of various heat flux perturbations on the core-exit coolant temperature in a pressurized water reactor (PWR). These perturbations can be associated with the fuel or the coolant. We have studied the effects of these on the dynamic responses, which are considered to be random processes. The analysis showed that the effect on the core-exit coolant temperature, of perturbations of the heat deposited in the fuel, was most influential in the frequency range 0-1 Hz. This analysis is made by transforming the dynamic model to the frequency domain and estimating the contribution to the power spectrum of the core-exit temperature from various perturbations. Further studies showed that the perturbations in the coolant flow rate was more dominant on the core-exit temperature than the perturbations in the inlet coolant temperature. The analysis of operational data from a commercial PWR showed high coherence between the neutron signal and the core-exit temperature signal, also in the 0-1 Hz frequency range. This observation, together with a multivariate time-series modeling of the signals, demonstrated the existence of unidirectional flow dynamics between the neutron and the temperature signals. Investigations of this type are useful in understanding the mechanism of coolant temperature "noise" behavior, the factors influencing inadequate core cooling (that is, deviation from normal heat transfer), and the sources of perturbations that affect the temperature signals. Also, diagnostic information such as coolant flow monitoring and sensor fault monitoring can be obtained using dynamic modeling and operational data.

4637 (Trans-WH—572) Recent findings on the coolant flow in pressurised water reactors. Ulrych, G.; Weber, E. Translated from *Atomkernenergie/Kerntechnik ;* **42**: No. 4, vp(1983). 13p. NTIS (US Sales Only), PC A02. File Number DE84900834. DE84900834

Coolant flow in the pressure vessels of pressurized water reactors is a very complex three-dimensional hydraulic flow which is almost unapproachable even by the most rigorous theoretical calculation. Knowledge of this flow is however indispensable for, for example thermohydraulic core design, for determination of component stressing and thus for ensuring fault-free operation. In order to obtain this necessary information, a comprehensive experimental measurement program was undertaken on reactor models. The investigations embraced in detail the flow conditions in the annulus of the pressure vessel, at core inlet, in the upper plenum and in the primary pipework. The results achieved are presented in the form of a survey.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 2103004674, 4710, 4714

4638 (AERE-R—11306) Sensitivity study on the failure frequencies derived for the Sizewell 'B' reactor pressure vessel. Cameron, R.F. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). May 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780214.

In a previous report the author derived best-estimate failure frequencies for the Sizewell 'B' reactor pressure vessel. This report presents the results obtained by varying some of the parameters which underlie these failure frequencies. These sensitivities are limited to a) variations in mean fracture toughness; b) using a different crack incidence function; c) varying the crack density; and d) re-examining the treatment of the small steam line break. In addition a comparison between the present results and results obtained by European workers is made.

4639 (CONF-840891—1) CERL/ORNL research and development programs in support of prestressed concrete reactor vessel development. Hornby, I.W.; Naus, D.J. (Central Electricity Research Labs., Leatherhead (UK); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 14p. NTIS, PC A02. File Number DE84016561.

From Symposium on concrete pressure and storage vessels; Calgary, Alberta, Canada (25 Aug 1984).

In support of the evolution of PCRV designs being developed both in the UK and USA, research and developments programmers are being conducted at the CEGB Central Electricity Research Laboratories (CERL) and the Oak Ridge National Laboratory (ORNL) respectively. In the UK, recent work has focused on elevated temperature effects on concrete properties and instrument systems for PCRVs. The concrete development program at ORNL consists of generic studies designed to provide technical support for ongoing prestressed concrete reactor vessel-related activities, to contribute to the technological data base, and to provide independent review and evaluation of the relevant technology. Recent activities have been related to the development of properties for high-strength concrete mix designs for the PCRV of a 2240 MW(t) HTGR-SC/C lead plant project, and the development of PCRV model testing techniques.

4640 (JAERI-M—83-092) Irradiation experiments of coated particle fuel in JRR-2, VT-1 hole. Kikuchi, Teruo; Ikawa, Katsuichi; Matsushima, Hideo; Ishimoto, Kiyoshi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1983. 88p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE84703290.

Reduced size fuel compacts for HTGR which were sealed in V1F-16H and V1F-24H capsule, were irradiated in VT-1 irradiation hole of JRR-2 for 2 or 3 cycles at 600 to 1350 °C. The purpose of these experiments are to obtain the information on the irradiation behaviour of coated particle fuel. The maximum fast neutron fluence is about 6.4×10^{18} (n/cm²) (E > 1 MeV). From these experiments, initial state of radial crack in buffer coating and initiation of circumferential crack between buffer layer and inner high density pyrocarbon layer were found and radiation induced shrinkage on length and diameter of fuel compacts are 0.3 to 0.4% and less than 0.1% respectively.

4641 (JAERI-M—83-093) Development of an apparatus for cyclic corrosion test in simulated VHTR helium environment. Suzuki, Tomio; Shindo, Masami; Kondo, Tatsuo. (Japan Atomic Energy Research Inst., Tokyo). Jul 1983. 19p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703291.

A test apparatus was designed and constructed to carry out corrosion tests in simulated VHTR environment, which allowed circulation of helium with closely controlled impurity chemistry under either isothermal or cyclic heating conditions. The principal features of the apparatus are as follows: (1) Test section are made of fused quartz. (2) Four specimens are exposed at a time, each being set in independent cell under equivalent condition. (3) Either thermal-cycled or isothermal tests can be performed. (4) Spalled oxide are recovered in the quartz tube for quantitative gravimetry and the subsequent neutron activation analysis of the constituents of corrosion products. The apparatus is connected to the helium loop with purification, impurity injection and circulation function, which was designed to supply continuously the simulated VHTR helium for material testing. The loop has supplied the helium to corrosion, creep and fatigue test apparatus for over 6×10^4 hours since 1976. The test environment contained controlled quantities of impurities, H_2, H_2O, CO, CO_2 and CH_4. Pressure and maximum flow rate of helium are 0.5kg/cm²G and 50 l/min. at outlet of the loop, respectively. Typical tests results are shown to demonstrate that quantitative measurements of the oxidation kinetics for very long test duration are readily available regardless of film spallation, and that the precise analysis of major constituents of the spalled products is also possible.

4642 **(OEFZS—4264) Post-irradiation examination of HTR-fuel at the Austrian Research Centre Seibersdorf Ltd.** Reitsamer, G.; Proksch, E.; Stolba, G.; Strigl, A.; Falta, G.; Zeger, J. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Feb 1984. 27p. (CH—327/84). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780082.

This paper describes methods and measurements developed at the Austrian Research Centre Seibersdorf for the evaluation of the irradiation performance of HTR fuel. Main interest is concentrated on particle failure rates, fission product release, burn-up and inventory measurements (solid and gaseous fission products, uranium inventory).

4643 **High-cycle fatigue behavior of Incoloy alloy 800H in a simulated HTGR helium environment containing high moisture levels.** Soo, P.; Sabatini, R.L. (Brookhaven National Laboratory, Upton, New York 11973). *Nuclear Technology;* **66**: No. 2, 324-346(Aug 1984).

A study has been carried out to evaluate the highcycle fatigue strength of Incoloy alloy 800H in a high-temperature gas-cooled reactor helium environment containing significant quantities of moisture. As-heat-treated and thermally aged materials were tested to determine the effects of long-term oxidation in the helium test gas. Results from these tests were compared to those for a standard air environment. It was found that the mechanisms of fatigue failure were complex and involved recovery/recrystallization of the surface-ground layer on the specimens, sensitization, work hardening, oxide scale integrity, and oxidation at the tips of propagating cracks. For certain situations, a corrosion-fatigue process seems to be important. However, for the helium environment studied, the fatigue strength was nearly always higher than that for air.

4644 **Relationship of H_2O and CH_4 supply rates in HTGR helium to the carburization of Hastelloy-X and alloy 800H.** Inouye, H. (Metals and Ceramics Division, Oak Ridge, Tennessee 37831). *Nuclear Technology;* **66**: No. 2, 392-403(Aug 1984).

A detailed study of the carburization of Hastelloy-X and alloy 800H in high-temperature gas-cooled reactor helium was made to determine the cause of the wide variability of data generated in retorts. Data for 1000°C and 2500-h exposure show that up to an order of magnitude difference in the carburization levels can be caused by changes in the flow rate of the test gas and/or the position of the corrosion specimen in the gas stream. The results are unambiguously explained by the parameters $S(H_2O)$ and $S(CH_4)$, the supply rates of water and methane, respectively.

4645 **The effects of controlled impurity helium on the mechanical behavior of Hastelloy Alloy X.** Li, C.C.; Johnson, W.R.; Thompson, L.D. (Hughes Aircraft EDSG, Mail Station E1-F157, P.O. Box 902, El Segundo, California 90245). *Nuclear Technology;* **66**: No. 2, 439-464(Aug 1984).

The influence of a simulated advanced reactor helium environment, containing 50 Pa H_2/5 Pa CH_4/ 5 Pa CO/ about 0.1 Pa H_2O, on the mechanical properties of two heats of Hastelloy alloy X is discussed. Simultaneous exposures in air and controlled impurity helium at temperatures in the range of 650 to 1000°C for times of 3000 h or more were performed. A combination of tensile testing, Charpy V-notch impact toughness testing, and creep testing was used to study the effects of reactor helium/metal interactions on the mechanical behavior of this alloy. Carburization was identified as the primary corrosion phenomenon. Increasing exposure time and temperature were observed to increase the depth of carburization. The increase in carbon concentration in the carburized zone suppressed the additional formation of M C, which is observed in air-aged specimens, and resulted in the precipitation of $M_{23}C_6$ a chromium-rich carbide variant. The precipitation of $M_{23}C_6$ in the carburized zone occurred primarily along grain and twin boundaries; matrix precipitation, however, was also observed, the degree of which depended on exposure temperature. Strength and impact toughness properties were found to be controlled primarily by thermal aging reactions, with only a small effect related to the carburization. Although tensile and creep ductilities were decreased as a result of carburization, substantial ductility remained. Variation was observed between the two heats, the finer grained heat appearing to be weaker in the high-temperature creep tests and also possibly more susceptible to a loss of creep strength as a result of carburization.

4646 **Creep rupture properties of Hastelloy-X and Incoloy-800H in a simulated HTGR helium environment containing high levels of moisture.** Lee, K.S. (Brookhaven National Laboratory, Upton, New York 11973). *Nuclear Technology;* **66**: No. 2, 241-249(Aug 1984).

Creep rupture tests on Incoloy-800H and Hastelloy-X have been carried out in a simulated steamcycle high-temperature gas-cooled reactor helium environment containing a high level of moisture. For the maximum test time of 16 000 h, the creep rupture behavior of Incoloy-800H in the helium environment was not significantly different from that in air. Hastelloy-X showed a slightly lower rupture life in helium in comparison with standard air tests. Surface cracks initiated at the grain boundaries penetrating surface and cavities formed at the grain boundary triple points have been identified as major fracture mechanisms in both environments. Oxidation was the only gas/metal interaction observed in the helium environment.

4647 **Inconel-618E: An alloy developed for high-temperature gas-cooled reactor service.** Lingenfelter, A.C. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Nuclear Technology;* **66**: No. 1, 63-68(Jul 1984).

Inconel-618E (54 Ni-23 Cr-6 W) was developed specifically to meet the requirements of the hightemperature gas-cooled reactor (HTGR). The alloy has good fabricability, weldability, and, above all, metallurgical stability. Alloy 618E is free of cobalt and aluminum. At temperatures of 954°C (1750°F) and higher, alloy 618E has stress rupture strength comparable to Inconel-617. At lower temperatures, the rupture strength of alloy 618E is somewhat lower than that of alloy 617. Alloy 617 remains the best-established alloy for HTGR service. However, alloy 618E does not have that material's disadvantage of aluminum and cobalt content and may become a candidate for HTGR applications.

4648 **Hastelloy-X for high-temperature gas-cooled reactor applications.** McCoy, H.E.; King, J.F.; Strizak, J.P. (Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee 37831). *Nuclear Technology;* **66**: No. 1, 161-174(Jul 1984).

Hastelloy-X is a potential structural material for use in gas-cooled reactor systems. In this application, data are necessary on the mechanical properties of base metal and weldments under realistic service conditions. The test environment studied was helium that contained small amounts of H_2, CH_4, and CO. This environment was found to be carburizing, with the kinetics of this process becoming rapid above 800°C. Suitable weldments of Hastelloy-X were prepared by several processes; those weldments generally had the same properties as base metal except for lower fracture strains under some conditions. Some samples were aged for up to 20000 h in the test gas and tested, and some creep tests on as-received material exceeded 40000 h. The predominant effects of aging were the significant reduction in the fracture strains at ambient temperature and the lower strains for samples aged in high-temperature gas-cooled reactor (HTGR) helium than for those aged in inert gas. Under some conditions, aging also resulted in increased yield and ultimate tensile strength. Creep tests failed to show the effects of environment, aging, or welding on the creep strength of Hastelloy-X; however, the fracture strains for weldments were generally lower than they were for base metal. Prior aging in inert gas for 20000 h at 538 and 871°C reduced the fatigue life slightly, but no difference was observed in the fatigue properties of samples aged in air and HTGR helium environments.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 2105004338, 4688, 4715, 4729, 4739

4649 **(AERE-R—11133) General aspects of modelling transient molten fuel motion in a channel using the two-phase-flow fluid equations.** Wickens, L.M. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Feb 1984. 13p. HMSO, London, price Pound 4.00.

Hypothetical core-disruptive fast-breeder reactor accidents may lead to the failure of fuel pins and the dispersal of molten fuel by fuel vaporization and/or fission gas release. The CABRI series of experiments is designed to study the effects of such hypothetical accidents on a single fast-breeder fuel pin placed in a cylindrical containment channel. Analysis of the CABRI experiments requires the development of computer codes and one such code is that required for molten fuel dispersal in a sodium voided channel. The paper presents a brief general discussion of the channel two-phase-flow fluid equations with a mass source term. An illustration of the connection between homogeneous and slug type models is also derived.

4650 **(ENEA-RT/ING—82-27) In pile programme of first valuation of UO_2 + PuO_2 fuel produced by a new process (GSP).** Caracchin, R.; Lanchi, M.; Marinucci, G.; Nobili, A.; Dupont, G.; Galtier, J. (ENEA, Rome (Italy)). 1982. 4p. (In Italian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780211.

The main scope of the ENEA-AGN-CEA programme collaboration is a first valuation of fuel elements produced by GSP method. This valuation will be done by in reactor experiment which enable to compare the performance of GSP and 'standard' FBR fuels. The composition is done by means of theree experimental device: P3, Lugel and Digel. The P3 device gives a direct measurement during irradiation of fuel central temperature, power and integral conductivity. The Lugel device measures fuel stack axial variations and Digel device gives the diameter variations of the pin and PCMI.

4651 **(ENEA-RT/ING—83-4) Lagrangian analysis of explosive models with simple inner structures.** Daneri, A.; Trombetti, G.; Orefice, L.; Trombetti, T. (ENEA, Rome (Italy)). 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780216.

Fast reactor model explosive experiments with inner structures interposed between the explosive energy source and the containment vessel have been analyzed in the paper, with reference to the COVA saries experiments IT/10, IT/11, It/12. Capability and limitations of a Lagrangian fluid dynamics analysis in such experimental conditions have been discussed. The ENEA version of the Lagrangian code ASTARTE-4 has been used in the computations.

4652 **(FEI—1496) Calculation of heat exchange in a post burnout region of sodium heated steam-generating channels.** Bazhin, V.G.; Grachev, N.S.; Kardash, D.Yu.; Khudasko, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703292.

A water droplet evaporation process is investigated in a steam line between an evaporator and a steam superheater of the BN-600 reactor. The calculation method of heat exchange is presented in a transition zone from developed boiling to a post burnout region and in a post burnout region itself. A multigroup calculation model of heat exchange for fluid drops in superheated vapour is used. The FORTRAN program has been prepared to solve the problem. The computerized calculation results are presented for pressure being equal to 13.7 MPa, flow rate - 0.5 kg/s and mass rate - 700 kg/m²xs. The calculations show that Reynolds and Nusselt drop numbers increase with drop diameter increasing and superheated vapour temperature decreasing. A concentration distribution function of drops, depending on diameters, corresponds to Nukiyama-Tanasawa distribution at the beginning of the post burnout region. While moving along the channel length, the function changes and differs considerably from the first distribution. The calculation results of drop diameter changes in superheated vapour along the channel length show that drops of smaller sizes evaporate quicker. The calculations of temperature changes in water and vapour are also presented as well as the changes of vapour content along the steam-generating channel length. The calculations of sodium temperature along the length of a steam generator model agree well with the experimental data.

4653 **(HEDL-SA—3156-FP) Remote handling equipment design for the HEDL fuel supply program.** Metcalf, I.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 8p. (CONF-841105—38). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003010.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

A process line is currently being developed for fabrication of high exposure mixed uranium-plutonium core assemblies. This paper describes the design philosophy, process flow, equipment, and the handling and radiation shielding techniques used for inspection of Fast Flux Test Facility (FFTF) fuel pins and assembly of Driver Fuel Assemblies (DFAs) 6 figures.

4654 **(HEDL-SA—3218-FP) Remote cutting of irradiated fuel ducts at FFTF.** Romrell, D.M. (Hanford Engineering Development Lab., Richland, WA (USA)). 25 Oct 1984. Contract AC06-76FF02170. 16p. (CONF-841105—40). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002998.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

The fuel disassembly station in the Interim Examination and Maintenance Cell, at the Fast Flux Test Facility in Richland, Washington, utilizes both horizontal and vertical duct cutting equipment that is remotely controlled by a computer. Operator friendly computer software and feedback control have contributed to successful duct cutting and removal from highly irradiated fuel assemblies even where significant duct dilation has occurred. This finely controlled system with safeguard features has been utilized to successfully disassemble several fuel assemblies. Subsequent fuel pin examinations have verified the expected material and fuel performance and provide the basis for extending the fuel lifetime.

4655 **(HEDL-SA—3226) Cost reduction through improved seismic design.** Severud, L.K. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 16p. (CONF-841164—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002997.

From International symposium on LMFBR development; Tokyo, Japan (6 Nov 1984).

During the past decade, many significnt seismic technology developments have been accomplished by the United States Department of Energy (USDOE) programs. Both base technology and major projects, such as the Fast Flux Test Facility (FFTF) and the Clinch River Breeder Reactor (CRBR) plant, have contributed to seismic technology development and validation. Improvements have come in the areas of ground motion definitions, soil-structure interaction, and structural analysis methods and criteria for piping, equipment, components, reactor core, and vessels. Examples of some of these lessons learned and technology developments are provided. Then, the highest priority seismic technology needs, achievable through DOE actions and sponsorship are identified and discussed. Satisfaction of these needs are expected to make important contributions toward cost avoidances and reduced capital costs of future liquid metal nuclear plants. 23 references, 12 figures.

4656 (JAERI-M—83-041, pp 68-80) **Sensitivity analysis based on generalized perturbation theory. Application to sodium void worth in FBRs.** Takeda, Toshikazu (Osaka Univ., Suita (Japan). Faculty of Engineering). Mar 1983. (In Japanese). NTIS (US Sales Only), PC A11/MF A01. File Number TI83902446. (CONF-821193—; NEANDC(J)—90/AU; INDC(JAP)—77/G).

From JAERI seminar on nuclear data; Tokai, Japan (24 Nov 1982).

The calculational procedure of a SAGEP code is described which calculates sensitivity coefficients in a two-dimensional model by means of generalized perturbation theory, and sensitivity coefficients calculated in a fast critical assembly are discussed. Sensitivity coefficients as well as neutron fluxes and eigenvalues are calculated on the basis of diffusion theory. The applicability of a round-off-error elimination method is numerically tested in calculating generalized normal and adjoint fluxes. Sensitivity coefficients for eigenvalue, sodium void worth, reaction rate ratio, and reaction rate distribution in a fast critical assembly ZPPR-9 are calculated by using the JENDL-2B-70 group cross section set. It is seen that the difference between JENDL-1 and 2B ^{239}Pu (n,f) cross sections in energy range from 0.5 to 2 KeV produces a difference of 15% in calculated sodium void worth, and the cross section in that energy range plays an important role in neutronic properties in FBRs.

4657 (JAERI-M—83-041, pp 102-118) **Sensitivity analysis of fast reactor burn-up reactivity.** Zukeran, Atsushi (Hitachi Ltd., Ibaraki (Japan). Energy Research Lab.); Watanabe, Takashi. Mar 1983. (In Japanese). NTIS (US Sales Only), PC A11/MF A01. File Number TI83902446. (CONF-821193—; NEANDC(J)—90/AU; INDC(JAP)—77/G).

From JAERI seminar on nuclear data; Tokai, Japan (24 Nov 1982).

Large reactivity discrepancy (0.5% Δk, 1σ) based on International Intercamparison for large fast reactor burn-up is discussed from the nuclaerear data point of view. For simplicity, an error evaluation formula is analyticaly derived from the neutron balance, and the effect on the burn-up reactivity due to nuclear data uncertainties of ^{239}Pu and ^{238}U is investigated by using the analytical formula. As the result, it seems that the required accuracy for burn-up reactivity, 0.2% Δk. exists beyond the ability of current evaluated data as it is clear from the existing nuclear data uncertainties. And thus, the cross section adjustment by integral data, as an alternative approach, is proposed.

4658 **(JAERI-M—83-075) Study of group constant generation method in fast reactor analysis.** Takano, Hideki. (Japan Atomic Energy Research Inst., Tokyo). May 1983. 383p. NTIS (US Sales Only), PC A17/MF A01. File Number DE84703279.

The methods of generating group constants have been studied to predict accurately the nuclear characteristics of fast reactors. In resonance energy region, the accuracy of the group constants was investigated, which were calculated by the approximate weighting spectrum used for a conventional standards group constant set such as ABBN. It was shown that the basic assumption of constant collision density for group constant calculation was not always satisfactory. Moreover, a multilevel formula was derived without losing the useful characteristics of the Breit-Wigner single level formula. Using this formula, the interference effect between resonances was examined. In addition, the mutual interference between different resonant nuclides was calculated. The cause of a systematic dependence of effective multiplication factors on U-238 concentration ratio was studied, and the cross section adjustment was performed. In the unresolved resonance region, the average resonance parameters were searched. As a result, the JFS-2 set was generated, and several studies were performed to advance the concept of the group constant set JFS-2.

4659 **(PNCT-N—941-83-15) Boiling and dryout in the PNC LOCAL blockage experiments with 37-pin bundles.** Yamaguchi, K.; Haga, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Feb 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703295.

Sodium boiling and dryout behavior behind planar blockages were examined with three 37-pin bundle experiments of different spacer and blockage type. Boiling inception within the grid spacer cells, closed on one side by the blockage, caused vigorous sodium boiling and subsequent dryout due to the restricted freedom of coolant movement. Local boiling behind the central blockage in the wire-wrapped pin bundle usually resulted in an oscillatory boiling pattern, while the transition to the stable boiling pattern was identified in one case. The edge blockage in the similar wire-wrapped bundle produced oscillatory or stable boiling patterns depending on the flow rates. The difference and transition in the flow patterns were analyzed from the viewpoint of the volume balance of the vapor cavity to adjust the thermal and hydraulic boundary conditions at the two-phase interface region. The dryout data were intercompared to account for the location of the dryout position and the critical condition of the onset of local dryout. This study led to a model in which the liquid film on the pins within the vapor cavity varies in quantity mainly through the entrainment generation and the deposition of the entrained droplets.

4660 **Temporal superposition of thermal transient stresses for piping analysis.** Kumar, S.; Mello, R.M. (Westinghouse Electric Corporation, Madison, Pennsylvania). *American Society of Mechanical Engineers, [Paper]*; **84-PVP-5**: 6(Jun 1984). (CONF-840647—).

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

The fatigue damage evaluation of piping components, such as elbows, using Equation (11) of Article NB-3650 of the ASME Boiler and Pressure Vessel Code, Section III, requires the specification of the range of stresses due to the thermal expansion moments and thermal gradients through the pipe wall thickness. In a simplified code evaluation, the thermal expansion stresses and the stresses due to through-wall temperature gradients are calculated by independent analyses and the maximum stresses from the two loadings are assumed to be occurring concurrently, i.e., their temporal variation is ignored. For thin-wall elbows, typical of Liquid Metal Fast Breeder Reactor (LMFBR) sodium piping, the high thermal expansion stresses, when combined with the steep through-wall gradients, result in a fictitiously high stress range. This conservatism in calculation is studied here using typical LMFBR transients for the heat transport system (HTS). For typical sodium transients, the results show that the maximum thermal expansion stresses based on the average pipe temperature and the maximum through-wall stresses do not occur at the same instant and a significant reduction in the calculated maximum stress range can be achieved by the temporal superposition of these two effects. The corresponding fatigue damage for the piping components is also expected to be considerably lower. A simple post-processing approach is proposed to calculate a realistic stress intensity range.

4661 **Structural analysis of an LMFBR shield assembly duct under thermo-mechanical and seismic loads.** Malik, S.N.; Sazawal, V.K. (Advanced Energy Systems Division, Westinghouse Electric Corporation, Madison, PA). *American Society of Mechanical Engineers, [Paper]*; **84-PVP-40**: 9(Jun 1984). (CONF-840647—).

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

This paper describes the stress analysis performed to assess structural adequacy of the Clinch River Breeder Reactor (CRBR) core removable shield assemblies. Removable shield assemblies are located in the peripheral region of the core (between blanket assemblies and the fixed radial shield), and are subjected to severe cross-sectional thermal gradients and seismic loads requiring a relatively complex duct load pad design. For cost-effectiveness, the analysis was conducted in two stages. First, an elasto-plastic seismic stress analysis was performed using a detailed nonlinear finite element model (with gaps) of the load pad configuration. Next, in order to determine the total strain accumulation and the creep-fatigue damage the maximum seismic stresses combined with the "worst" thermal stresses from a single assembly model were used to perform a simplified inelastic analysis using two sets of material properties to bound the changing material conditions during reactor operation. This work demonstrated the necessity and applicability of the two simplified analysis techniques in elevated temperature structural design, i.e., the treatment of time-dependent degradation of material properties due to temperature and nuclear irradiation, and the use of time-independent finite element stress analysis results to perform a simplified creep-fatigue analysis.

4662 **Results from dynamic tests and analyses of a medium diameter LMFBR piping system.** Schott, G.A.; Heberling, C.F.; Hulbert, G.M. (Westinghouse Electric Corporation, Advanced Energy Systems Division, Madison, Pennsylvania). *American Society of Mechanical Engineers, [Paper]*; **84-PVP-19**: 8(Jun 1984). (CONF-840647—).

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

This paper presents results and observations from dynamic tests and analyses performed on a 0.20 m (8 in.) diameter, thin walled piping system. The piping system is a scaled representation of a Liquid Metal Fast Breeder Reactor (LMFBR) large diameter piping loop. Prototypic piping restraints were employed, including mechanical snubbers, rigid struts, pipe hangers and non-integral pipe clamps. Snapback, sine-sweep and seismic tests were performed for various restraint configurations and piping conditions. The test results are compared to analytical predictions for verification of the methods and models used in the seismic design of LMFBR piping systems. Test program conclusions and general recommendations for piping seismic analyses are presented along with a discussion of test and analysis results.

4663 **Dynamic structural analysis of a head assembly for a large loop-type LMFBR.** Kulak, R.F.; Fiala, C. (Reactor Analysis and Safety Division, Argonne National Laboratory, Argonne, Illinois). *American Society of Mechanical Engineers, [Paper]*· **84-PVP-41**: 5(Jun 1984). (CONF-840647—).

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

An investigation is presented here on the dynamic structural response of the primary vessel's head closure to slug impact loadings generated from a 1000 MJ source term. The reference reactor considered was designed in a loop configuration. The head structure consisted of a deck and a triple rotatable plug assembly. Two designs were considered for the deck structure: a reference design and an alternate design. The reference deck was designed as a single flat annular plate. For the alternate design, the deck plate was reinforced by adding an extender cylinder with a flange and flanged webs between the deck-plate and cylinder. This investigation showed that the reference design cannot maintain containment integrity when subjected to slug loading generated by a 1000 MJ source term. It was determined that the head deformed excessively. The excessive deformation would, at least, permanently disengage the HCDA seals. More importantly, however, it appears that the entire TRP assembly would be disengaged from the deck creating a large opening for sodium expulsion. With regard to the alternate design, the computations indicated that the deck deformations were acceptable and that no sodium expulsion would occur at the deck-plug juncture.

4664 **Materials technologies of breeder reactors.** DiStefano, J. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 9-10 of Shaping our energy future. Knoxville, TN, USA; LTM Consultants (1984). (CONF-840229—).

From 11. annual WATTec conference and exposition - shaping our energy future; Knoxville, TN, USA (21 Feb 1984).

Abstract only.

In a breeder reactor, more nuclear fuel is produced than is consumed in the process of producing electrical power. Of the several different breeder concepts, the liquid metal fast breeder reactor (LMFBR) has been selected for development and commercial deployment by the United States and foreign countries such as France, the United Kingdom, West Germany, Japan, and the Soviet Union. Adequate materials technologies are essential for the design and licensing of this reactor system. These technologies include High Temperature and Seismic Design, Mechanical Properties, Fabrication, Tribology, Coolant, and Nondestructive Testing. The objective of the U.S. Materials and Structures Program is to provide the technological basis for assuring that LMFBR components and systems will perform satisfactorily during their design lifetimes. With a trend toward reduced growth in energy demand, economic factors such as capital costs play an increasingly important role. Accordingly, it is necessary to have data and criteria that are technically sound, not overly conservative, and provide broad flexibility in component and system design. Materials technologies are required for each stage in the development of breeder reactors: design, fabrication, and operation. The principal design criteria and requirements for construction of pressure boundary components for nuclear applications are established by the American Society of Mechanical Engineers (ASME) through its Boiler and Pressure Vessel (BPV) Code. The alloys currently approved for applications at elevated temperatures are types 304 and 316 stainless steel, alloy 800H, and 2 1/4 Cr-1 Mo steel. For near-term applications, such as the recently cancelled Clinch River Breeder Reactor, selection of structural materials for high temperature application has been limited to these materials.

4665 **(LA-tr—84-33) Present status of uranium-plutonium mixed carbide fuel development for LMFBR.** Handa, Muneo; Suzuki, Yasufumi. Translated from *Nippon Genshiryoku Gakkaishi ;* **26**: No. 1, 2-7(1984). Contract W-7405-ENG-36. 13p. NTIS, PC A02. File Number DE84017212. DE84017212

One Oarai characteristic of a carbide fuel is that its doubling time is about 13 years which is only about half as long as that of an oxide fuel. The development of carbide fuels in the past ten years has been truly remarkable. Especially, through the new fuel development program initiated in 1974 in the United States, success has been achieved with respect to He- and Na-bond fuels in obtaining a 16 a/o burning rate without damage to cladding tubes. In 1984 at FFTF, a radiation of a fuel assembly consisting 91 fuel pins is contemplated. On the other hand, in Japan, in 1974, a Fuel Research Wing specializing in the study of carbide fuels was constructed in the Oarai Laboratory of the Atomic Energy Research Institute and in the fall of 1982, was successful in fabricating two carbide fuel pins having different chemical compositions.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

4666 **(AN-AGCR—412) Fuel capsule fission product activities, counting methods and data correlations.** Peak, R.D. (Aerojet-General Nucleonics, San Ramon, CA (USA)). 1 May 1963. 135p. (AN-IDOP—86). NTIS, PC A07. File Number DE84017622.

For the purposes of Phase I Testing of the ML-1 Reactor, many of the experiments conducted provided for the measurement of fission power inside the reactor core by the irradiation of small fuel capsules in experimental fuel elements. These fuel capsules sampled the fission power at various locations and the irradiation-induced fission product gamma activities of the capsules were taken as the measurement of fission power. The induced gamma activities of these capsules were measured using activated sodium iodide scintillation crystal counting techniques. This memorandum summarizes the available data describing the counting done for the various experiments, the counting equipment and techniques utilized, the cutoff energy and dead time corrections required, and the relationships between activity data taken using the various counting apparatus.

4667 **(AN-FDD—210) ML-1 fuel element maximum operating temperature. Summary report.** Calamore, D. (Aerojet-General Nucleonics, San Ramon, CA (USA)). 5 Sep 1961. 20p. NTIS, PC A02. File Number DE84016691.

The purpose of this report is to summarize investigations made to determine the maximum fuel element cladding temperature expected in the ML-1 reactor.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 2107004635, 5592

4668 **(NUREG—0040-Vol.8-No.3) Licensee contractor and vendor inspection status report. Quarterly report, July-September 1984. Volume 8, No. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Oct 1984. 182p. NTIS, PC A09/MF A01 - GPO*. File Number TI85900174.

The NRC Vendor Program Branch inspects the implementation of QA programs of nuclear steam supply system designers and architect engineering firms which have been submitted to and ap-

proved by the NRC in the form of Topical Reports or Standardized Programs. Upon completion of inspections confirming satisfactory implementation of QA programs, NRC will issue a confirming letter to the nuclear steam system supplier or architect engineering firm. The White Book contains information normally used to establish a qualified suppliers list; however, the information contained in this document is not adequate nor is it intended to stand by itself as a basis for qualification of suppliers.

4669 **(NUREG—0940-Vol.3-No.3) Enforcement actions: significant actions resolved. Quarterly progress report, July-September 1984. Volume 3, No. 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Oct 1984. 286p. NTIS, PC A13/MF A01 - GPO*. File Number TI85900381.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (July-September 1984 and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions and the licensees' responses. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, in the interest of promoting public health and safety as well as common defense and security.

4670 **(NUREG—1097) Technical specifications: Byron Station Unit No. 1 (Docket No. STN 50-454). Appendix A to License No. NPF-23.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1984. 475p. NTIS, PC A20/MF A01 - GPO* $11.00. File Number TI85900382.

Specifications are presented concerning safety limits; reactor control systems; instrumentation; coolant circuits; emergency core cooling systems; containment systems; plant systems; electrical power systems; refueling operations; radioactive effluents; radiological environmental monitoring; design features; and administrative controls.

4671 **(REG/G—1.147) USNRC regulatory guide.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Jul 1984. 5p. NTIS, PC A02/MF A01 - GPO. File Number TI84900274.

This regulatory guide lists those Section XI ASME Code Cases that are generally acceptable to the NRC staff for implementation in the inservice inspection of light-water-cooled nuclear power plants. Any guidance in this document related to information collection activities has been cleared under OMB Clearance No. 3150-0011.

2108 Economics

REFER ALSO TO CITATION(S) 2108004355, 4719

4672 **(CONF-841099—3) Initial development of an automated task analysis profiling system.** Jorgensen, C.C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002479.

From Human Factors Society annual meeting; San Antonio, TX, USA (22 Oct 1984).

A program for automated task analysis is described. Called TAPS (task analysis profiling system), the program accepts normal English prose and outputs skills, knowledges, attitudes, and abilities (SKAAs) along with specific guidance and recommended ability measurement tests for nuclear power plant operators. A new method for defining SKAAs is presented along with a sample program output.

4673 (IHZ-WK—81-380, pp 144-148) **Optimization of nuclear power plant operation in future in the view of the whole energy system.** Pavlov, V.; Sotirov, I.; Panevski, I.; Kanev, D. (NIPPIES 'Energoprojekt', Sofia (Bulgaria)). 1982. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780209. (CONF-8205180—Pt.2).

From 6. scientific conference on power economy; Zittau, German D.R. (11 May 1982).

A linear optimization model is presented for the calculation of the economic effectiveness of different ways of nuclear power plant operation. Load management studies, cost analysis, and econometric calculations are carried out.

2109 Process Heat Reactors

REFER ALSO TO CITATION(S) 2109004710, 6161, 6204

4674 **Design of wrought nickel-base alloys for advanced high-temperature gas-cooled reactor applications.** Johnson, W.R.; Lechtenberg, T.A.; Thompson, L.D. (GA Technologies Inc., P.O. Box 85608, San Diego, California 92138). *Nuclear Technology;* **66**: No. 1, 88-101(Jul 1984).

The utilization of the high-temperature gas-cooled reactor (HTGR) for advanced or process heat applications will require the use of wrought components operating at temperatures up to 1000°C (1832°F) for times approaching 30 yr. Alloys for such components must withstand the corrosive effects (carburization and oxidation) of the impure helium primary coolant environment and maintain adequate elevated temperature strength. Commercially available wrought alloys have been found to be seriously limited for such applications because of their inherently poor resistance to corrosion in impure helium. As one approach to the solution of this problem, a program has been initiated to develop wrought alloys having a better combination of corrosion resistance and high-temperature strength, under advanced HTGR conditions, than commercial alloys currently available. This program culminated in 1980 with the design, melting, and fabrication of ten experimental Ni-Cr-Mo-W-Al-Ti-Zr-C alloys and with the initiation of efforts to evaluate their corrosion and mechanical behavior. Results of tests showed that all the experimental alloys exhibited superior carburization resistance in advanced reactor helium. In addition, several of the alloys exhibited excellent mechanical properties, including, in the case of one alloy, creep rupture strength at 900°C (1652°F), significantly better than that of the commercial alloy Inconel-617.

22 NUCLEAR REACTOR TECHNOLOGY

4675 **(DP-MS—84-53) Three-dimensional, near real-time neutronics simulation model.** Gregory, M.V.; Yakura, S.J.; Aviles, B.N. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Singer Co., Silver Spring, MD (USA). Link Simulation Systems Div.; Arizona Univ., Tucson (USA)). 1984. Contract AC09-76SR00001. 19p. (CONF-841105—36). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002826.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

In support of the Savannah River Training Simulator, a fast-running, three-dimensional computer model of the reactor core has been developed.

2201 Theory And Calculation

4676 **(PNCT-N—952-82-13) Data processing program for transient sodium boiling and fuel failure propagation tests, (2). SICILIAN: a computer code for inspecting measuring circuit anomaly.** Hasebe, Takeshi; Isozaki, Tadashi; Satoh, Akihiro; Yamaguchi, Katsuhisa; Haga, Kazuo. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Jan 1983. 82p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE84703310.

Transient Sodium Boiling Tests and Fuel Failure Propagation Tests are being conducted with the out-of-pile test facility, SIENA, in the Core Safety Section of O-arai Engineering Center. The experimental data are recorded using a digital data acquisition system controlled by a HP-1000E computer. The SICILIAN (Speedy Illustration Code for Inspection Line Anomaly) code was developed to obtain quick graphic outputs of data recorded in the magnetic tapes. The program is written in BASIC and Assembler languages and uses a data processing system composed of a desktop

computer HP 9845B, a magnetic tape system, a magnetic disc and an eightcolor plotter. The SICILIAN code enables us to get graphic outputs soon after a run. These outputs are very helpful to inspect anomaly in the instrument circuit and to check the experimental conditions of coming runs.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 2202004655, 4898, 5106

4677 **(NUREG/CR—2000-Vol.3-No.9) Licensee Event Report (LER) compilation: for month of September 1984.** (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 104p. (ORNL/NSIC—200-Vol.3-No.9). NTIS, PC A06/MF A01 - GPO. File Number TI85000596.

This monthly report contains Licensee Event Report (LER) operational informtion that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the month of September, 1984. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

4678 **(NUREG/CR—3691-Rev.) Assessment of terminal blocks in the nuclear power industry.** Craft, C.M. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 139p. (SAND—84-0422-Rev.). NTIS, PC A07/MF A01 - GPO. File Number TI85003123.

The primary application of terminal blocks in the nuclear power industry is instrumentation and control (I and C) circuits. The performance of these circuits can be degraded by low level leakage currents and low insulation resistance (IR) between conductors or to ground. Analyses of these circuits show that terminal blocks, when exposed to steam environments, experience leakage currents and low surface IR levels sufficient to affect some I and C applications. Since the mechanism reducing surface IR (conductive surface moisture films) is primarily controlled by external environmental factors, the degradation of terminal block performance is mostly independent of terminal block design. Testing shows that potential methods of reducing surface leakage currents will not reduce them sufficiently to prevent terminal blocks from affecting I and C circuits. Therefore, terminal blocks can cause erroneous indications or actions of the I and C circuits in which they are a component. Most of the present qualification tests of terminal blocks do not address the issue of low level leakage currents, and hence do not demonstrate that terminal blocks will operate properly in I and C circuits.

4679 **(NUREG/CR—3891) SAMCR: a two-dimensional dynamic finite element code for the Stress Analysis of Moving CRacks.** Schwartz, C.W.; Chona, R.; Fourney, W.L.; Irwin, G.R. (Maryland Univ., College Park (USA)). Nov 1984. Contract AC05-84OR21400. 270p. (ORNL/Sub—79-7778/3). NTIS, PC A12/MF A01 - GPO. File Number TI85000410.

The mathematical formulation, program structure, and details of required input data are described for SAMCR, a two-dimensional dynamic finite element code for the Stress Analysis of Moving CRacks. The code has been shown, through an extensive series of verification analyses, to perform well in modeling dynamic behavior of both uncracked and cracked structures. In particular, the code has been demonstrated to provide useful information regarding run-arrest events in polymeric laboratory samples and large thermally shocked steel cyclinders. Complete documentation of the code has been included so that this document can serve as both a technical manual and a user's manual for the code.

4680 **(PNL-SA—12475) Overview of NRC funded NDE research at US Pacific Northwest Laboratory.** Doctor, S.R.; Taylor, T.T.; Hutton, P.H. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 16p. (CONF-8410189—1). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. File Number DE85003117.

From 10. MPA seminar on safety of light water reactor pressure vessels; Stuttgart, F.R. Germany (11 Oct 1984).

It is felt that these programs are making significant contributions to the safety of nuclear reactor operation through improved nondestructive evaluation information. The NDE/Reliability Program has identified weaknesses in standard ultrasonic inspection methods and ways for overcoming these weaknesses. SAFT-UT work is substantiating the validity of the technique for improved flaw characterization in the field. The AE program is demonstrating the feasibility of utilizing AE methods for continuous surveillance of flaw growth in reactor pressure boundaries.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 2203004758, 4917

4681 **(AERE-R—11159) Investigation of the FGR series 40 to 52 experiments using the TRAFIC and NEFIG codes.** Matthews, J.R.; Wood, M.H.; Robins, N.G. (UKAEA Atomic Energy Research Establishment, Harwell. Theoretical Physics Div.). Nov 1983. 32p. (FFWG-P—83-14). HMSO, London, price Pound 5.00.

The experiments FGR 40 to 52, performed at the Hanford Engineering Development Laboratory, are the best characterized set of out-of-pile data on the release of fission gases from solid fuel at high temperatures (> 2000°C). The tests have been simulated using the TRAFIC code and the results compared with the experimental data. The agreement with overall gas release measurements is encouraging. Particular attention has been paid to the behaviour of intragranular bubbles, and the bubble sizes and concentrations have been compared with the observations.

4682 (ND-R—921(S), pp 27-40) **Role of electron microscopy in the UKAEA Northern Division.** Sumerling, R. (UKAEA Windscale Nuclear Power Development Labs.); Cawthorn, C. (UKAEA Dounreay Nuclear Power Development Establishment); Slattery, G. (UKAEA Risley Nuclear Power Development Labs.); Bilsby, C.F. (UKAEA Springfields Nuclear Power Development Labs.). Sep 1983. HMSO, London, England Pound 6.00. (CONF-8209257—).

From 30. UKAEA diffraction analysis conference; Oxford, UK (28 Sep 1982).

The role of electron microscopy in the Northern Division of the UKAEA is to assist in the development of safe and efficient nuclear power, particularly in optimising fuel element performance, but also to solve the materials problems which arise in both nuclear and non-nuclear plant. Some of the fuel element investigations under-taken in the past 25 years are reviewed under six headings: compatibility of different materials - fuel, cladding and coolant; dimensional stability of the fuel element; heat transfer from fuel to coolant; fission gas release from the fuel; cladding integrity and causes of failure; and safety. The various types of thermal reactor and fast reactors pose different materials problems, but similarities abound and often experience with one system can be of value in another. Current investigations are discussed.

2204 Control Systems

REFER ALSO TO CITATION(S) 2204005208, 5216

4683 **(BMI—1984-044) Modelling of reactor control and protection systems in the core simulator program GARLIC.** Beraha, D.; Lupas, O.; Ploegert, K. (Bundesministerium des Innern, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Jul 1984. 75p. (In German). (GRS-A—924). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750014.

For analysis of the interaction between control and limitation systems and the power distribution in the reactor core, a valuable tool is provided by the joint simulation of the core and the interacting systems. To this purpose, the core simulator GARLIC has been enhanced by models of the systems for controlling and limiting the reactor power and the power distribution in the core as well as by modules for calculating safety related core parameters. The computer-based core protection system, first installed in the Grafenrheinfeld NPP, has been included in the simulation. In order to evaluate the accuracy of GARLIC-simulations, the code has been compared with a design code in the train of a verification phase. The report describes the program extensions and the results of the verification.

4684 **(CONF-841007—18) Simulation of the TREAT-Upgrade Automatic Reactor Control System.** Lipinski, W.C.; Kirsch, L.W.; Valente, A.D. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002737.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

This paper describes the design of the Automatic Reactor Control System (ARCS) for the Transient Reactor Test Facility (TREAT) Upgrade. A simulation was used to facilitate the ARCS design and to completely test and verify its operation before installation at the TREAT facility.

4685 (FS—83-30-T, pp 293-296) **Use of computers for radiation protection purposes, illustrated by the KKW's Gundremmingen.** Capelle, M.; Berg, D.;; Poeschl, A. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The dual computer system (VAK 11/780, DEC) has the following functions: Personnel dose monitoring, access control, workplace monitoring, dose metering for special purposes, routine γ spectroscopy, emission monitoring, meteorology and other power-plant-specific data.

4686 (IHZ-WK—81-380, pp 1-34) **First evaluation of low frequency noise measurements of in core detector signals in the measuring assembly Rheinsberg.** Collatz, S. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1982. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780209. (CONF-8205180—Pt.2).

From 6. scientific conference on power economy; Zittau, German D.R. (11 May 1982).

Reactor noise spectra of in core neutron detectors are measured in the low frequency range (0.03 Hz to 1 Hz) and evaluated. The increase of the effective noise signal value is due to pressure oscillations or oscillations of special steam volume portions. Thus boiling monitoring of reactor cores in PWR type reactors may be possible, if the low frequency noise of the whole set of in core detectors is taken into account.

4687 **(ZfK—517) Representation of nuclear reactor information by means of colour CRT display - a contribution to man-machine communication.** Stein, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Jan 1984. 7p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780212.

A data representing technique of special nuclear reactor measurement values by means of colour CRT display is discribed. The data of an incore measurement system are logged continously. A primary data processing is followed by a calculation of selected incore parameters. The parameters are offered the operator on a colour display completed by other important values of the conventional reactor instrumentation. The method is realized by the microprocessor system ursadat 5000, robotron 1600, and MPS 4944. The bit-serial data transmission requires a line interface working in a multipoint regime. The software consists of modules to allow the insertion in a superordinate automation system.

4688 **(ZfK—519) CMEA specialists' seminar on control and measurement devices and systems for fast reactors.** (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyanniya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh). 1983. 376p. (In Russian). (CONF-8304158—). NTIS (US Sales Only), PC A17/MF A01. File Number DE85780210.

From CMEA seminar on surveillance and diagnostic systems for fast breeder reactors; Papstdorf, German D.R. (25 Apr 1983).

The papers of the CMEA seminar on control and measurement systems for fast reactors are included. Section A is devoted to control and diagnostics of reactor performance including noise methods, variations analysis, reactivity calculations. Section B comprises control of vapor generators and other sodium cooled components. Leak and accoustic testing are emphasized. Section C covers systems and devices, such as transducers for measurement and control of flow, pressure and temperature. Papers on quality control of sodium coolants are comprehended in section D.

4689 **(ZJE—267) Role of man in ensuring the safety of nuclear devices.** Bilek, M. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780213.

The impact of the human factor on the safety and reliability of nuclear power plant operation is discussed and its critical aspects are pointed out: shortcomings in the design of the control room, in the organization and control of the plant and in regulations and working procedures and errors in the training of operators. The question is discussed of the operator's behavior during predicted and unpredicted failure of the system and his ability to recieve and process information. Securing the safe and reliable operation of nuclear power plants can substantially influence the current attitude of the public to their construction.

4690 **A system for automated diagnosis of Reactor Coolant Pumps.** Gabler, H.C.; Stevens, D.M. (Babcock and Wilcox Co., Lynchburg, VA 24505). pp 34.01-34.14 of Proceedings of the fifth power plant dynamics, control and testing symposium. Vol. 2. Upadhyaya, B.R. Knoxville, TN, USA; The University of Tennessee (1983). (CONF-830318—).

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

The Reactor Coolant Pump Monitoring and Diagnostic System (RCPM & DS), developed by Babcock & Wilcox, is an advanced microcomputer-based system designed for and totally dedicated to the specialized engineering needs of reactor coolant pump diagnostics. The purpose of the RCPM & DS is to continuously monitor reactor coolant pump performance, and provide early warning of conditions that could lead to pump deterioration or failure. Specifically, RCPM & DS will monitor and automatically evaluate: Rotodynamic behavior of the pump shaft and related components. Seal internal conditions and performance. Plant, or operating, environment (controlled by the plant operator). For more in depth analysis, the RCPM & DS will build a historical record of pump performance on magnetic tape - which can be analyzed on demand by the engineer to reveal long term trends or performance patterns. This paper describes the function and implementation of the RCPM & DS as installed at Toledo Edison Company's Davis-Besse Nuclear Power Station Unit 1.

4691 **Computing and cognition in future power plant operations.** Kisner, R.A.; Sheridan, T.B. (Oak Ridge National Lab., Oak Ridge, TN). pp 25.01-25.11 of Proceedings of the fifth power plant dynamics, control and testing symposium. Vol. 2. Upadhyaya, B.R. Knoxville, TN, USA; The University of Tennessee (1983). (CONF-830318—).

From 5. power plant dynamics control and testing symposium; Knoxville, TN, USA (21 Mar 1983).

The intent of this paper is to speculate on the nature of future interactions between people and computers in the operation of power plants. In particular, the authors offer a taxonomy for examining the differing functions of operators in interacting with the

plant and its computers, and the differing functions of the computers in interacting with the plant and its operators.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 2205004359, 5219, 5220, 5225, 5230, 5275

4692 **(FS—83-30-T, pp 313-323) Environmental monitoring between femtocurie concentrations and accident prevention.** Winter, M. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The state of the art of environmental monitoring in the vicinity of nuclear power plants during normal operation is reviewed. The author criticizes excessive sensitivity demands which would require extremely long measuring times or gigantic amounts of radioactive materials at the onset of the enrichment process. Further, clear concepts for emission monitoring in case of accidents are still lacking, and the existing regulations are inconsistent with regard to the potential hazards and appropriate countermeasures. Routine and preventive environmental monitoring involves low-level measurements as well preventive measures in case of an incident or accident. This means an extremely wide measuring range - a fact which is often left out of account when suitable sampling and measuring techniques are selected.

4693 **(KURRI-TR—232) Research on the property and behaviour of natural (radioactive) aerosols in the KUR reactor room.** (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1 Dec 1982. 105p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE84703261.

A research has been carried out by the KUR Aerosol Research Group as one of the Visiting Researchers Programs of the Kyoto University Research Reactor Institute. This report presents results obtained through a five series of measurements, and consists of in chapter 1. a summary of this research, in chapter 2. instrumental techniques, procedures used here and surrounding conditions, in chapter 3. the outline about items interested in as well as the outline of the results obtained after the analysis by the group. The tables and figures of every thirty minutes data and some typical photographs are contained in the appendix.

4694 **(NUREG—0683-Suppl.1) Programmatic Environmental Impact Statement: related to decontamination and disposal of radioactive wastes resulting from March 28, 1979 accident Three Mile Island Nuclear Station, Unit 2 (Docket No. 50-320). Final supplement dealing with occupational radiation dose. Supplement No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Three Mile Island Program Office). Oct 1984. 175p. NTIS, PC A08/MF A01 - GPO $6.00. File Number TI85900283.

In accordance with the National Environmental Policy Act, the Programmatic Environmental Impact Statement Related to Decontamination and Disposal of Radioactive Wastes Resulting from March 28, 1979 Accident Three Mile Island Nuclear Station, Unit 2 has been supplemented. The supplement was required because current information indicates that cleanup may entail substantially more occupational radiation dose to the cleanup work force than originally anticipated. Cleanup was originally estimated to result in from 2000 to 8000 person-rem of occupational radiation dose. Although nearly 2000 person-rem have resulted from cleanup operations performed up to now, current estimates now indicate that between 13,000 and 46,000 person-rem are expected to be required. Alternative cleanup methods considered in the supplement either did not result in appreciable dose savings or were not known to be technically feasible.

4695 **(NUREG—1087) Draft Environmental Statement related to the operation of Vogtle Electric Generating Plant, Units 1 and 2 (Docket Nos. 50-424 and 50-425).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1984. 312p. NTIS, PC A14/MF A01 - GPO*. File Number TI85900357.

This Draft Environmental Statement contains an assessment of the environmental impact associated with the operation of the Vogtle Electric Generating Plant, Units 1 and 2, pursuant to the National Environmental Policy Act of 1969 (NEPA) and Title 10 of the Code of Federal Regulations, part 51 (10 CFR 51), as amended, of the Nuclear Regulatory Commission regulations. This statement examines the environmental impacts, environmental consequences and mitigating actions, and environmental and economic benefits and costs associated with station operation.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 2206004630, 4654, 4693, 4709, 4716

4696 **(CONF-841017—4) On-line noise monitoring at the Fast Flux Test Facility.** Mullens, J.A.; Thie, J.A.; Campbell, L.R. (Oak Ridge National Lab., TN (USA); Analysis and Measurement Services, Knoxville, TN (USA); Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002473.

From Specialists' meeting on reactor noise - SMORN IV; Dijon, France (15 Oct 1984).

An automated noise surveillance and diagnostics system (ANSDS) is being demonstrated at the Fast Flux Test Facility (FFTF). Three low-level, in-vessel fission chambers (LLFMs), three ex-vessel compensated ion chambers (CICs), and two accelerometers on the mechanism of one advanced absorber (ADVAB) control rod were monitored with an automated noise surveillance and diagnostic system (ANSDS) in late 1983.

4697 **(CONF-8410142—26) LWR surveillance dosimetry improvement program: PSF metallurgical blind test results.** Kam, F.B.K.; Maerker, R.E.; Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002500.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The metallurgical irradiation experiment at the Oak Ridge Research Reactor Poolside Facility (ORR-PSF) was designed as a benchmark to test the accuracy of radiation embrittlement predictions in the pressure vessel wall of light water reactors on the basis of results from surveillance capsules. The PSF metallurgical Blind Test is concerned with the simulated surveillance capsule (SSC) and the simulated pressure vessel capsule (SPVC). The data from the ORR-PSF benchmark experiment are the basis for comparison with the predictions made by participants of the metallurgical "Blind Test". The Blind Test required the participants to predict the embrittlement of the irradiated specimen based only on dosimetry and metallurgical data from the SSC1 capsule. This exercise included both the prediction of damage fluence and the prediction of embrittlement based on the predicted fluence. A variety of prediction methodologies was used by the participants. No glaring biases or other deficiencies were found, but neither were any of the methods clearly superior to the others. Closer analysis shows a rather complex and poorly understood relation between fluence and material damage. Many prediction formulas can give an adequate approximation, but further improvement of the prediction methodology is unlikely at this time given the many unknown factors. Instead, attention should be focused on determining realistic uncertainties for the predicted material changes. The Blind Test comparisons provide some clues for the size of these uncertainties. In particular, higher uncertainties must be assigned to materials whose chemical composition lies outside the data set for which the prediction formula was obtained. 16 references, 14 figures, 5 tables.

4698 **(CONF-8410173—1) Irradiation performance of low-enriched uranium fuel elements.** Copeland, G.L.; Hofman, G.L.; Snelgrove, J.L. (Oak Ridge National Lab., TN (USA); Argonne National Lab., IL (USA)). 14 Oct 1984. Contract AC05-84OR21400;W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000172.

From International meeting on reduced enrichment for research and test reactors; Argonne, IL, USA (14 Oct 1984).

The status of the testing and evaluation of full-sized experimental low- and medium-enriched uranium fuel elements in the Oak Ridge Research Reactor is presented. Medium-enriched elements containing oxide and aluminide have been completely evaluated at burnups up to 75%. A low-enriched U_3Si_2 element has been evaluated at 41% burnup. Other silicide and oxide elements have completed irradiation satisfactorily to burnups of 75% and are now being evaluated. All results to date confirm the expected good performance of these elements in the medium power research reactor environment.

4699 **(HEDL-SA—3038) In-reactor creep rupture experiment in MOTA.** Puigh, R.J.; Schenter, R.E. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 16p. (CONF-840604—28). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003012.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

The capabilities of the Materials Open Test Assembly (MOTA) irradiation vehicle and the FFTF cover gas monitoring system are described in relation to the creep rupture experiment during FFTF Cycle 2 operation. The creep rupture specimen matrix in MOTA includes both US and foreign alloys at irradiation temperatures of 575, 605, 670 and 750°C. For exposure times less than 2400 hours and fluences less than 3.2×10^{22} n/cm² (E > 0.1 MeV), neutron irradiation does not impact the rupture times for the US alloys irradiated in MOTA.

4700 **(HEDL-SA—3108-FP) Reactivity anomaly surveillance in the Fast Flux Test Facility through cycle 3.** Knutson, B.J.; Harris, R.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76FF02170. 12p. (CONF-840901—20). NTIS, PC A02. File Number DE85001065.

From ANS topical meeting on reactor physics and shielding; Chicago, IL, USA (17 Sep 1984).

The technique for monitoring core reactivity during power operation used at the Fast Flux Test Facility (FFTF) is described. This technique relies on comparing predicted to measured rod positions to detect any anomalous (or unpredicted) core reactivity changes. It is implemented on the Plant Data System (PDS) computer and thus provides rapid indication of any abnormal core conditions. The prediction algorithms use thermal-hydraulic, control rod position and neutron flux sensor information to predict the core reactivity state. Initial results of using this technique based mainly on theoretical formulations is presented. The results show that the reactivity changes due to increasing reactor power (power defect) and burnup of the fuel were within ~ 16% of predicted values. To increase the sensitivity and accuracy of this technique, the prediction algorithms were calibrated to actual operating data. The work of calibrating this technique and the results of using the calibrated technique up through the third full operating cycle are summarized.

4701 **(HEDL-SA—3159-FP) Performance of FFTF reference fuel and control assemblies.** Leggett, R.D.; Weber, E.T. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76FF02170. 26p. (CONF-841105—41). NTIS, PC A03/MF A01; GPO Dep. File Number DE85003013.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

This paper describes the performance of the reference fuel and control assemblies used in FFTF through the first four cycles of irradiation (446 equivalent full power days, EFPD). These assemblies performed flawlessly through the rigors of the Startup Testing Program, STP, (beginning in late 1979) with its cyclic operation and continued to do so throughout Cycles 1, 2, 3 and 4, the latter ending in April 1984.

4702 (JAERI-M—83-041, pp 91-101) **Burn up experiments of JOYO fuels.** Ikegami, Tetsuo (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Mar 1983. (In Japanese). NTIS (US Sales Only), PC A11/MF A01. File Number TI83902446. (CONF-821193—; NEANDC(J)—90/AU; INDC(JAP)—77/G).

From JAERI seminar on nuclear data; Tokai, Japan (24 Nov 1982).

Fast experimental reactor JOYO obtained maximum burn up of 40200 MWD/T (bundle average) through its operation. Burn up related experiments such as measurement of burn up coefficient, mass analysis, and fuel substitution reactivity measurements are successfully conducted. The experimental results agreed comparatively well with the predicted values.

4703 **(NIIAR—21(586)) System for calculating the BOR-60 reactivity balance.** Afanas'ev, V.A.; Efimov, V.N.; Eshchenko, S.N.; Kachalin, V.A.; Nikol'skij, A.S.; Pridachin, V.N. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703293.

The method for diagnostics of the nuclear reactor state based on reactivity balance calculation is considered. The flowsheet and basic characteristics of the reactivity balance control system for the BOR-60 reactor performed on the base of the Electronica D3-28 computer are given. The system is realized in the VECTOR standard. The system testing results have shown that it reliably operates for 70-90 days. When using a simplified algorithm the real sensitivity of the system to anomalies at frequencies above 10^{-2} Hz constitutes $(2\text{-}3)\times10^{-5}$ ΔK/k, while the low-frequency range it attains $(15\text{-}20)\times10^{-5}$ ΔK/k. The latter is partially due to variations and ambiguity of reactivity effects. The subsequent complication of the algorithm taking into account the dynamics of reactivity effects and dependence of power coefficient on the coolant flow rate will permit to increase the real sensitivity of the system in the high-frequency range.

4704 **(PNC-J—265-82-01) Study on neutron streaming effect in a large fast critical assembly, (2).** Takeda, Toshikazu; Tanimoto, Koichi; Ono, Shunji. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Mar 1982. 84p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE84703280.

Sodium void worths in plate and pin environments and fuel slumping reactivity worths measured in the FCA assembly have been analysed to investigate calculational methods, especially to check methods to estimate the neutron streaming effect. Comparison of sodium void worths in plate and pin environments has been done experimentally in the FCA VI-2 assembly. In this report we investigate the effect of cell modeling on calculated void worths and clarify problems in calculational methods. The fuel slumping reactivity worths were measured in the FCA VIII-2 assembly. Though some analyses have been performed, there is a case where the calculated slumping reactivity worths differ remarkably. Then we recalculated the worths taking into account the neutron streaming effect, and compared the results with the previous ones. All the analyses have been carried out on the basis of transport calculations with the JENDL-2B-70 group cross section set. The neutron streaming effect was considered by means of Benoist's diffusion coefficient or the unified diffusion coefficient which includes the neutron streaming interference effect between different drawers.

4705 **(PNC-N—930-81-03) Outline of performance test plan for irradiation core of fast experimental reactor 'Joyo'.** (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). Jun 1982. 54p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE84703294.

This progress report is a quarterly report in which the work achievement of the Engineering Section and the operational results of the Joyo have been reported for two years since April, 1980. From April, 1982, this is changed to the report of the whole Fast Experimental Reactor Division. The test items of the performance test of the MK-2 core and the characteristic test of the irradiation bed and the schedule were decided after the coordination among

the sections concerned. The analysis of the nuclear-thermal characteristics of the MK-2 core (0-th cycle) and the planning of fuel replacement from first to 10th cycle were carried out. The subcriticality monitoring work during the transition period to the MK-2 core was started in February, 1982. General progress, the achievement in reactor technology, the activities of various committees in the Division, the plan of the studies on reactor technology, the foreign information on FBRs, the reports published by the Engineering Section and the presentation of papers to outside, and the plan of the performance test of the MK-2 core are reported. It is scheduled to perform the performance test of the MK-2 core and attain the continuous 100 hours operation at 100 MW output by March, 1983, thus obtain the certificate.

4706 **(TM—63-6-702) Design criteria maritime prototype test facility (2nd issue).** (General Electric Co., Idaho Falls, ID (USA). Flight Propulsion Lab. Dept.). 18 Jun 1963. 55p. NTIS, PC A04. File Number DE84017124.

These criteria define the requirements for the construction of a maritime prototype test facility (MPTF) at Test Areas North (TAN), National Reactor Testing Station in Idaho. The maritime prototype test area will be located approximately 5000 feet southeast of the existing LPT and EBOR facilities and 2-1/4 miles southeast of the Technical Support Facilities (TSF). The facility shall be connected to the TSF area by a paved road. The Maritime Prototype Test Facility is basically a single purpose, isolation type installation consisting of three major inter-related components as follows: the test building enclosing the 630A Nuclear Steam Generator; an auxiliary test equipment building; and a control and equipment building. The major components of the maritime prototype test facility are adjacent to each other and are attached together. A detailed description including functions, relationships and construction features of the major components of the maritime prototype test facility are presented.

4707 **(UTRCN-G—12) Report on progress of researches by common utilization of JAERI nuclear facilities, for fiscal 1982.** (Tokyo Univ. (Japan). Research Center for Nuclear Science and Technology). 1983. 383p. (In Japanese). NTIS (US Sales Only), PC A17/MF A01. File Number DE84703311.

The utilization of the facilities in the Japan Atomic Energy Research Institute in 1982 has finished in active state, and the results of the reasearch efforts have reacheaed the stage of publication. The subjects of the reaseasearch efforts spread over wide fields, and in 1982 also, extremely diversified research efforts were carried out. In this report, theses results were collected in one book, and it is desirable to utilize it actively. The number of the research themes is 131. In the field of general research, the research o n radiochemistry, the utilization of radiation and the effects of irradiation were mostly carried out, while in cooperative research efforts, the reasearch was mainly concerned with nuclear reactor engineering and nuclear reactor materials. The total number of visitors was 3025. The facilities offered to the common utilization were JRR-2, JRR-3, JRR-4, Co-60 irradiation facility and others. The abstracts of the papers are reported.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 2207004404, 4640, 4707

2208 Propulsion Reactors

REFER ALSO TO CITATION(S) 2208004706

2209 Reactor Safety

REFER ALSO TO CITATION(S) 2209004692, 4693, 4694, 5062, 5226, 5294

4708 **(AD-A—142207/0) Data base analysis for perceptions of emergency programs. Final report.** (Yankelovich, Skelly and White, Inc., Stamford, CT (USA)). Feb 1984. 137p. NTIS, PC A07/MF A01.

This document reviews data bases to identify implications for emergency programs. Topics covered include: (1) Planning to Respond to Nuclear Incidents; (2) Hazardous Materials; (3) Other Man-Made Disasters; (4) Climate for Emergency Behavior; (5) Information/Credibility Issues; and (6) Considerations for the Federal Emergency Management Agency.

4709 **(ANL-OHS/HP—84-106) Radiological survey support activities for the decommissioning of the Ames Laboratory Research Reactor Facility, Ames, Iowa.** Wynveen, R.A.; Smith, W.H.; Sholeen, C.M.; Justus, A.L.; Flynn, K.F. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 83p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85002655.

At the request of the Engineering Support Division of the US Department of Energy-Chicago Operations Office and in accordance with the programmatic overview/certification responsibilities of the Department of Energy Environmental and Safety Engineering Division, the Argonne National Laboratory Radiological Survey Group conducted a series of radiological measurements and tests at the Ames Laboratory Research Reactor located in Ames, Iowa. These measurements and tests were conducted during 1980 and 1981 while the reactor building was being decontaminated and decommissioned for the purpose of returning the building to general use. The results of these evaluations are included in this report. Although the surface contamination within the reactor building could presumably be reduced to negligible levels, the potential for airborne contamination from tritiated water vapor remains. This vapor emmanates from contamination within the concrete of the building and should be monitored until such time as it is reduced to background levels. 2 references, 8 figures, 6 tables.

4710 **(BMI—1984-045) Development of fundamentals for a catalogue of rules on the design of HTR components for operating temperatures above 800°C.** Nickel, H.; Schubert, F.; Schuster, H.; Penkalla, H.J.; Over, H.H.; Scheidler, G.; Bieniussa, K.; Hahn, H.; Dette, M.; Hoffmann, M. (Bundesministerium des Innern, Bonn (Germany, F.R.)). Jul 1984. 221p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85750013.

In HTR operation, metallic heat exchanger components are subject to operating temperatures above 800°C. So far, there are no rules for component layout that take account of materials, design, and strength characteristics. The rules to be established will be based on a general safety concept for all safety-relevant components and heat exchangers. An analysis of the available rules and guidelines for conventional and nuclear power plants showed that the design philosophy of low-temperature components cannot be transferred to components exposed to temperatures above 800°C. The ASME-CC N 47 guideline covers the range up to 800°C; its design rules cannot be extrapolated to higher temperatures. The experience gained in the construction of the THTR (Thorium-Hochtemperaturreaktor) will be considered in the new guideline.

4711 **(BNL—34370) Role definition among public officials and emergency workers in a nuclear evacuation.** Metz, W.C. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 6p. (CONF-8307142—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000879.

From Workshop on natural hazards research and applications; Boulder, CO, USA (11 Jul 1983).

How public officials and emergency workers will resolve conflict between their official duties and assigned tasks and their family and conscience responsibilities is discussed in the context of the Indian Point nuclear station, and the Shoreham nuclear station. (ACR)

4712 **(BNL-NUREG—35195) Typical BWR/4 MSIV closure ATWS analysis using RAMONA-3B code with space-time neutron kinetics.** Neymotin, L.; Saha, P. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 12p. (CONF-841075—3). NTIS, PC A02/MF A01 - GPO. File Number TI85000573.

From International thermal hydraulics and plant operations topical meeting; Taipei, Taiwan (22 Oct 1984).

A best-estimate analysis of a typical BWR/4 MSIV closure ATWS has been performed using the RAMONA-3B code with three-dimensional neutron kinetics. All safety features, namely, the safety and relief valves, recirculation pump trip, high pressure safety injections and the standby liquid control system (boron injection), were assumed to work as designed. No other operator action was assumed. The results show a strong spatial dependence of reactor power during the transient. After the initial peak of pressure and reactor power, the reactor vessel pressure oscillated between the relief valve set points, and the reactor power oscillated between 20 to 50% of the steady state power until the hot shutdown condition was reached at approximately 1400 seconds. The suppression pool bulk water temperature at this time was predicted to be ~ 96°C (205°F). In view of code performance and reasonable computer running time, the RAMONA-3B code is recommended for further best-estimate analyses of ATWS-type events in BWRs.

4713 **(BNL-NUREG—35286) Containment leakage during severe accident conditions.** Hofmayer, C.H.; Bagchi, G.; Noonan, V.S. (Brookhaven National Lab., Upton, NY (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1984. Contract AC02-76CH00016. 14p. (CONF-8406124—13). NTIS, PC A02/MF A01 - GPO. File Number TI85000892.

From 2. workshop on containment integrity; Crystal City, VA, USA (13 Jun 1984).

An alternate to the THRESHOLD model used in most severe accident risk assessments has been investigated. One reference plant for each of six containment types has been studied to determine the magnitude of containment leakage that would result from the pressures and temperatures associated with severe accident conditions. Containment penetrations having the greatest potential for early containment leakage are identified. The studies indicate that containment leakage through penetrations prior to reaching containment threshold pressures (currently reported containment shell failure pressures) should be considered in severe accident risk assessments. Failure of non-metallic seals for containment penetrations can be a significant source of containment leakage under severe accident pressure and temperature conditions. Although studies of containment types are useful in identifying sources of containment leakage, final conclusions may need to be plant specific. Recommendations concerning future studies to better develop the use of continuous leakage models are provided. 9 references, 4 figures, 2 tables.

4714 **(CONF-840804—36) New approches for high temperature gas cooled reactors (HTGRs).** Kasten, P.R.; Cleveland, J.C.; Bowers, H.I. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 24p. NTIS, PC A02. File Number DE84016603.

From Intersociety energy conversion engineering conference; San Francisco, CA, USA (19 Aug 1984).

Several approaches are being evaluated in the US HTR Program to explore designs which might improve the commercial viability of nuclear power. The general approach is to reduce the power level of the reactor and increase ability to use passive methods for removing afterheat energy following extreme accidents. One approach most fully discussed in this paper is represented by modular HTRs for which the unit size and design are constrained such that extreme accidents do not result in significant release of radioactivity from the reactor circuit. Through such an approach, it should be possible to minimize the amount of nuclear grade components required in the balance-of-plant and achieve an economic system. Attaining such performance should provide low investment risk to the owner.

4715 **(CONF-841105—4) Influence of thermal buoyancy on vertical tube bundle thermal density head predictions under transient conditions.** Lin, H.C.; Kasza, K.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02. File Number DE84014765.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

The thermal-hydraulic behavior of an LMFBR system under various types of plant transients is usually studied using one-dimensional (1-D) flow and energy transport models of the system components. Many of the transient events involve the change from a high to a low flow with an accompanying change in temperature of the fluid passing through the components which can be conductive to significant thermal bouyancy forces. Thermal bouyancy can exert its influence on system dynamic energy transport predictions through alterations of flow and thermal distributions which in turn can influence decay heat removal, system-response time constants, heat transport between primary and secondary systems, and thermal energy rejection at the reactor heat sink, i.e., the steam generator. In this paper the results from a comparison of a 1-D model prediction and experimental data for vertical tube bundle overall thermal density head and outlet temperature under transient conditions causing varying degrees of thermal bouyancy are presented. These comparisons are being used to generate insight into how, when, and to what degree thermal buoyancy can cause departures from 1-D model predictions.

4716 **(CONF-841105—22-Summ.) Fuel-motion diagnostics for PFR/TREAT experiments.** DeVolpi, A.; Doerner, R.C.; Fink, C.L.; Regis, J.P.; Rhodes, E.A.; Stanford, G.S. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 4p. NTIS, PC A02. File Number DE84014723.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

In all the transients in the PFR/TREAT series, fuel motion had been monitored by the fast-neutron hodoscope. This paper treats the enhancements in hodoscope operation and data analysis since the start of the PFR/TREAT tests. The hodoscope has a maximum viewing height of 1.2 m. Data collection intervals for the series have been in the order of 1 ms, depending on the duration of the transient. Mass-displacement resolutions of about 0.1 g are achievable for the single-pin tests and 1 g for 7-pin tests. The hodoscope system can accommodate the full dynamic range of power.

4717 **(CONF-8410142—5) Efficient method for simulation of BWR severe accident sequence events before core uncovery.** Harrington, R.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000268.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

BWR-LACP has been a versatile tool for the ORNL SASA program. The development effort was minimal, and the code is fast running and economical. Operator actions are easily simulated and the complete scope of both reactor vessel and primary containment are modeled. Valuable insights have been gained into accident sequences. A Fortran version is under development and it will be modified for application to Mark II plants.

4718 **(CONF-8410142—11) Human factors review for Severe Accident Sequence Analysis (SASA).** Krois, P.A.; Haas, P.M.; Manning, J.J.; Bovell, C.R. (Oak Ridge National Lab., TN (USA); General Physics Corp., Chattanooga, TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001670.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The paper will discuss work being conducted during this human factors review including: (1) support of the Severe Accident Sequence Analysis (SASA) Program based on an assessment of operator actions, and (2) development of a descriptive model of operator severe accident management. Research by SASA analysts on the Browns Ferry Unit One (BF1) anticipated transient without scram (ATWS) was supported through a concurrent assessment of operator performance to demonstrate contributions to SASA analyses from human factors data and methods. A descriptive model was developed called the Function Oriented Accident Management (FOAM) model, which serves as a structure for bridging human factors, operations, and engineering expertise and which is useful for identifying needs/deficiencies in the area of accident management. The assessment of human factors issues related to ATWS required extensive coordination with SASA analysts. The analysis was consolidated primarily to six operator actions identified in the Emergency Procedure Guidelines (EPGs) as being the most critical

to the accident sequence. These actions were assessed through simulator exercises, qualitative reviews, and quantitative human reliability analyses. The FOAM descriptive model assumes as a starting point that multiple operator/system failures exceed the scope of procedures and necessitates a knowledge-based emergency response by the operators. The FOAM model provides a functionally-oriented structure for assembling human factors, operations, and engineering data and expertise into operator guidance for unconventional emergency responses to mitigate severe accident progression and avoid/minimize core degradation. Operators must also respond to potential radiological release beyond plant protective barriers. Research needs in accident management and potential uses of the FOAM model are described. 11 references, 1 figure.

4719 **(CONF-8410142—29) Simulator experiments: effects of NPP operator experience on performance.** Beare, A.N.; Gray, L.H. (General Physics Corp., Columbia, MD (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002466.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

During the FY83 research, a simulator experiment was conducted at the control room simulator for a GE Boiling Water Reactor (BWR) NPP. The research subjects were licensed operators undergoing requalification training and shift technical advisors (STAs). This experiment was designed to investigate the effects of senior reactor operator (SRO) experience, operating crew augmentation with an STA and practice, as a crew, upon crew and individual operator performance, in response to anticipated plant transients. Sixteen two-man crews of licensed operators were employed in a 2 x 2 factorial design. The SROs leading the crews were split into high and low experience groups on the basis of their years of experience as an SRO. One half of the high- and low-SRO experience groups were assisted by an STA. The crews responded to four simulated plant casualties. A five-variable set of content-referenced performance measures was derived from task analyses of the procedurally correct responses to the four casualties. System parameters and control manipulations were recorded by the computer controlling the simulator. Data on communications and procedure use were obtained from analysis of videotapes of the exercises. Questionnaires were used to collect subject biographical information and data on subjective workload during each simulated casualty. For four of the five performance measures, no significant differences were found between groups led by high (25 to 114 months) and low (1 to 17 months as an SRO) experience SROs. However, crews led by low experience SROs tended to have significantly shorter task performance times than crews led by high experience SROs. The presence of the STA had no significant effect on overall team performance in responding to the four simulated casualties. The FY84 experiments are a partial replication and extension of the FY83 experiment, but with PWR operators and simulator.

4720 **(ENEA-RT/ING—82-29) Influence of the representation models of the stress-strain law on the LMFBR structures in an HCDA.** Daneri, A.; Toselli, G.; Trombetti, T.; Blanche, Y.; Louvet, J.; Obry, P. (ENEA, Rome (Italy)). 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780215.

Most of analysis involved in mechanical calculations related to explosive accidents in fast breeder reactor are now aware of the inadequacy of certain roug stress-strain laws to representing the correct behaviour of vessel materials. Indeed stress waves along the vessel walls deform the material at high strain rate with multiaxial loading or reverse loading. Recently different questions have been under investigation in France in this direction and the present study, performed in the frame of the agreement CNEN-CEA, is an example of the way how two very important factors (strain rate and strain hardening) may be taken into account in the consecutive equations of materials subject to dynamic deformations. Several parametric calculations have been carried out with the hydrodynamic structural codes ASTARTE 3/4 and SIRIUS, which are the Lagrangian validated codes now available at the CNEN and CEA Cadarache Computing Centres. Analysis was performed by comparing two reference calculations relating to the MARA 01 and COVA IT7 explosive tests with experimental data and with other calculations in which different values of the initial hardening and of the strain rates of the tank shell material were introduced. In general both codes give similar results; improvements of predicted axial and hoop strain and of impulses in water have been reached in certain cases but it is difficult to find a general trend and there is no ideal constitutive model: indeed the strain rate is not constant in time, in place and in direction and some parts of the vessels are uniaxially loaded while others are multiaxially loaded.

4721 **(EUR—8633) Thermal and mechanical cutting of concrete and steel.** Kloj, G.; Tittel, G. (Commission of the European Communities, Luxembourg). 1984. 96p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780198.

Various thermal and mechanical processes for dismantling radioactive large components and concrete structures were investigated in order to determine the optimal handling conditions and their respective efficiency. For the thermal processes, the separation of heavy concrete and steel components by means of oxygen lances, powder cutting, ocyacetylene cutting, and plasma cutting processes were tested. In order to gain the necessary data for designing filtering equipment with regard to use in nuclear power stations, the amount of dust deposition and particle size distribution for these thermal processes were measured. The largest particle size proportion occurs for a particle size of ca. 0.3 μm. For the mechanical processes, stationary saws were used. Due to the large dimensions of the components which are to be found in a nuclear installation, it is not possible to use such saws for the initial dismantling. These saws can be used for both low-alloy and austenitic types of steel, and for separating materials not containing iron. In order to compare the efficiency of the saws with that of the thermal processes, to some extent the same test pieces were used that were used for the thermal tests. The advantage of the saw technique in comparison to the thermal separation processes lies in that next to no gas or dust contamination can become released. Also, the amount of shavings produced (secondary waste) is low. Furthermore, some of the saws can be used under remote control.

4722 (FS—83-30-T, pp 269-272) **Monitoring of live steam leakage in BWR reactors by means of continuous measurement of the aerosol activity transferred via a sampling line.** Labno, L.; Aubert, J.F.; Bartz, H.; Fissan, H.J. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The contaminated aerosols are withdrawn by an absolute filter, collected in the filter, and accumulated over the sampling time. The aerosol activity is measured at the same time. A sampling system consisting of pipelines and a central measuring station was designed for a BWR reactor plant. Among the main design criteria are data on losses of contaminated aerosols inside the sampling lines.

4723 (FS—83-30-T, pp 277-280) **Contamination, contamination protection and contamination measurement during a steam generator revision in a power plant with a pressurized water reactor.** Bader, D. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

For in-service eddy current inspection of steam generators, the inlet and outlet chambers must be opened on the primary side. The chambers must be entered several times for installation and removal of the test instruments or to seal a located defective tube. Inside the chambers, contamination and dose rates are high. Extensive measures and measurements are required to keep the personnel dose within the permissible range and to avoid incorporation, contamination of persons, and distribution of contaminants. The problems of workplace monitoring are discussed at length.

4724 **(JAERI-M—83-027) Evaluation report on CCTF core-I reflood test C1-5 (Run 14). Over-all system thermo-hydrodynamic behaviours observed in the base case test.** Murao, Yoshio; Akimoto, Hajime; Sudoh, Takashi; Okubo, Tsutomu. (Japan Atomic Energy Research Inst., Tokyo). Feb 1983. 69p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703283.

A study of a cylindrical core test facility (CCTF) test was performed for modeling the system behavior during the reflood phase of a PWR-LOCA and the following conclusions were obtained: 1) With the exception of some points, the observed phenomena are similar to a model derived from an evaluation model for a PWR safety evaluation. 2) The different points are the water accumulation in the upper plenum, the ECC bypass in the downcomer, the reduction of the effective downcomer head and the pressure drop at the broken cold leg nozzle and in the interconnected pipes.

4725 **(JAERI-M—83-067) PORV break calculations for the ROSA-IV LSTF and the reference PWR with RELAP5/MOD1 (cycle 1).** Tanaka, Mitsugu; Fineman, C.P.; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokyo). Apr 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703284.

Calculations simulating the failure of a single PORV were made for the ROSA-IV Large Scale Test Facility (LSTF) and the reference PWR with the RELAP5/MOD1, cycle 1, computer program. Comparison of the results showed that the initial higher steam generator secondary pressure and the smaller than scaled primary flow rate in LSTF affected the results for LSTF, however, the LSTF calculation compared well to the one for the PWR as a whole. This indicates LSTF should give results representative of the PWR in this situation. Both the calculation for LSTF and for the PWR showed the reactor pressure vessel upper head would remain voided even though the pressurizer was liquid full.

4726 **(JAERI-M—83-088) Loss-of-feedwater transient calculations for the ROSA-IV LSTF and the reference PWR with RELAP5/MOD1(Cycle 1).** Fineman, C.P.; Tanaka, Mitsugu; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 56p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703286.

The response of LSTF and the reference PWR to a variety of loss-of-feedwater (LOFW) transients was analyzed with the RELAP5/MOD1, Cycle 1, computer program. The transients analyzed included main feedwater loss only (base case), complete loss-of-feedwater (main and auxiliary), main feedwater loss plus turbine bypass valve failure and main feedwater loss plus primary coolant pump trip at reactor scram. These calculations were the first attempt to analyze the response of LSTF to an operational transient and, therefore, are not a final assessment of the system's capability to represent the PWR response. Comparison of the results showed that LSTF has the capability to simulate the basic PWR response to the base case LOFW, but with the assumption of an additional failure, there were differences in the response of LSTF and the PWR to the transient. Problem areas identified included the limitation of the core power and primary flow rate to 14% of the respective full-scale value, initial steam generator secondary mass and the method of jet condenser operation. Further study and analysis of the problem areas are recommended in order to find ways to improve the LSTF response relative to the PWR.

4727 **(JAERI-M—83-090) Evaluation report on CCTF Core-I reflood tests Cl-2 (Run 11) and Cl-3 (Run 12). Effects of initial superheat of the downcomer wall.** Akimoto, Hajime; Murao, Yoshio. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 93p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84703287.

In order to clarify the effect of the initial superheat of the downcomer wall on the system and the core cooling behaviors during the reflood phase of a PWR-LOCA, two tests were performed with the Cylindrical Core Test Facility (CCTF). One is the superheated wall test (test Cl-2) with the initial superheat of 79K, as in the actual PWR, and the other is the saturated wall test (test Cl-3) without any initial superheat. Through the comparisons of the test results from these two tests, the following conclusions were obtained. (1) The initial superheat of the downcomer wall resulted in the lower downcomer water head as observed in our separate-effect tests for the downcomer water head. (2) The superheat also caused the core inlet subcooling to be decreased, and led to the lower core water head. (3) The mass flow rate through the intact loop was reduced only by 4% by the initial superheat of the downcomer wall because the core water head was reduced as well as the downcomer water head whereas the mass flow rate through the broken loop was increased because of the increased pressure drop through the broken cold leg. (4) The difference of the core inlet mass flow rate was small between the superheated and the saturated wall tests. It can be considered that small difference of the core inlet mass flow rate results from the compensation of the decreased mass flow rate through the intact loops by the increased mass flow rate through the broken loop. (5) The main discrepancies of the core cooling and the carry-over behaviors between two CCTF tests, were consistent with those observed in the parametric tests for the core inlet subcooling of the FLECHT LOW FLOODING TEST series.

4728 **(JAERI-M—83-091) Evaluation report on CCTF core-I reflood tests Cl-5 (Run 14), Cl-10 (Run 19) and Cl-12 (Run 21). Effect of containment pressure.** Akimoto, Hajime; Murao, Yoshio. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 114p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703288.

Three tests Cl-5 (Run 14), Cl-10 (Run 19) and Cl-12 (Run 21) were performed using the Cylindrical Core Test Facility to study the effect of the containment pressure on the core cooling and the system behaviors during the reflood phase of a PWR-LOCA. The containment pressures of these tests were 0.15, 0.20 and 0.30 MPa for the tests Cl-10, Cl-5 and Cl-12, respectively. Through the comparison of the test results from these three tests, the following results were obtained. (1) The higher containment pressure gave the higher heat transfer coefficient in the core. This resulted in the lower turnaround temperature, the shorter turnaround time and the shorter quench time at the higher containment pressure. (2) In the higher containment pressure test, the higher core water head, the higher upper plenum water head, the higher downcomer water head in the early period and the lower downcomer water head in the later period were observed than those in the lower containment pressure test. This resulted in the higher pressure drop through the intact loop in the early period of the tests and the lower pressure drop in the later period of the test with the containment pressure. (3) The pressure drop through the broken cold leg pressurized the primary system. The pressure drop through the broken cold leg was decreased with the containment pressure. (4) The core inlet mass flow rate was increased with the containment pressure as observed in the FLECHT-SET phase B1 test. In quantity, however, the effect of the containment pressure on the increase of the core inlet mass flow rate was less in the CCTF than that in the FLECHT-SET. The less sensitivity in the CCTF was attributed mainly to the great pressure drop through the broken cold leg, which was not observed in the FLECHT-SET with big broken cold leg. (5) The system effect of the containment pressure was explained quantitatively.

4729 **(KFK—3687) Report on research and development activities in 1983 of the Hauptabteilung Ingenieurtechnik.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik). Feb 1984. 22p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE84752263.

The following projects have been treated for the main points of investigation of the R and D programme 1983: PSB: - Experiments with simulated core meltdown under sodium atmosphere for investigation of the behaviour of fission and activation products and fuel as well as of the cooling ability and compatibility of the melt with core-catcher materials. PKF: - Theoretical calculations concerning solidity for load experiments with a 3-coil arrangement in the TESPE test facility. PWR: - Development of gas purifiers for reprocessing plants. PNS: - Finishing of the BETA test facility for investigation of the interaction between steel melts and concrete and taking up of the start-up tests as well as performance of preliminary tests. Independent institutional research projects: Finishing of the planning work for elimination of the FR2 reactor block. Finishing of the planning works for elimination of the KKN. Completion

of the safety report and of the project description. Conception of a meltdown facility for low-level radioactive metal wastes.

4730 **(KURRI-TR—234) Computer utilization for improvement of safety of nuclear reactors.** Shibata, Shun-ichi; Murata, Yutaka; Nishihara, Hideaki. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1983. 146p. (In Japanese). (CONF-8208197—1). NTIS (US Sales Only), PC A07/MF A01. File Number DE84703282.

From Seminar on computer utilization for improvement of safety of nuclear reactors; Kumatori, Osaka, Japan (3 Aug 1982).

The development of instruction system for reducing the burden of operators and improving the reliability of nuclear power stations, the development of core operation and management system for BWRs and the method of adapting the analysis model for core characteristics to core conditions, the development of reactor management system for monitoring and forecasting core conditions in detail, the multi-function simulation system for nuclear power plants for analyzing plant characteristics and verifying the effectiveness of new systems, the examination of FBR operation and monitoring system using generalized model reference method, the development of forecasting system for environmental radioactivity and exposure dose in emergency, the backup computer system in Musashi Institute of Technology reactor using perfectly equal multi-processor system, the present status of on-line computer system for Kyoto University reactor for the research on computer control of a nuclear reactor, on-line and off-line data collection and analysis of operation characteristics of Kinki University reactor, renewal of measurement and control system for Rikkyo reactor, and the present status of change to on-line measurement and control of University of Tokyo reactor are reported.

4731 **(LA-UR—84-3315) TRAC-PF1/MOD1 computer code.** Liles, D.R.; Mahaffy, J.H. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8410142—24). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002381.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The TRAC-P1 program was designed primarily for the analysis of large-break loss-of-coolant accidents (LOCAs) in pressurized water reactors (PWRs). Because of its versatility, however, it can be applied directly to many analyses ranging from blowdowns in simple pipes to integral LOCA tests in multiloop facilities. A refined version, called TRAC-P1A, was released to the National Energy Software Center (NESC) in March 1979. Although it still treats the same class of problems, TRAC-P1A is more efficient than TRAC-P1 and incorporates improved hydrodynamic and heat-transfer models. It also is easier to implement on various computers. TRAC-PD2 contains improved reflood and heat-transfer models and improvements in the numerical solution methods. Although a large LOCA code, it has been applied successfully to small-break problems and to the Three Mile Island incident. Distinguishing characteristics of the TRAC-PF1/MOD1 are summarized.

4732 **(LA-UR—84-3316) TRAC-PF1/MOD1 assessment at Los Alamos.** Knight, T.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 21p. (CONF-8410142—23). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002380.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The Los Alamos National Laboratory is developing the Transient Reactor Analysis Code (TRAC) to provide an advanced best-estimate predictive capability for the analysis of postulated accidents in pressurized water reactors (PWRs). Over the past several years, four distinct versions of the code have been released; each new version introduced improvements to the existing models and numerics and added new models to extend the applications of the code. The first goal of the code was to analyze large-break loss-of-coolant accidents (LOCAs), and the TRAC-P1A and TRAC-PD2 codes primarily addressed the large-break LOCA. (The TRAC-PD2/MOD1 code is essentially the same as the TRAC-PD2 code but it also includes a released set of error corrections.) The TRAC-PF1 code contained major changes to the models and trips and to the numerical methods. These modifications enhanced the computational speed of the code and improved the application to small-break LOCAs. The TRAC-PF1/MOD1 code, the latest released version, added improved steam-generator modeling, a turbine component, and a control system together with modified constitutive relations to model the balance of plant on the secondary side and to extend the applications to non-LOCA transients. The TRAC-PF1/MOD1 code also contains reasonably general reactor-kinetics modeling to facilitate the simulation of transients with delayed scram or without scram. 13 references, 24 figures.

4733 **(LA-UR—84-3317) TRAC-PF1/MOD1 support calculations for the MIST/OTIS program.** Fujita, R.K.; Knight, T.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 22p. (CONF-8410142—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002390.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

We are using the Transient Reactor Analysis Code (TRAC), specifically version TRAC-PF1/MOD1, to perform analyses in support of the MultiLoop Integral-System Test (MIST) and the Once-Through Integral-System (OTIS) experiment program. We have analyzed Geradrohr Dampferzeuger Anlage (GERDA) Test 1605AA to benchmark the TRAC-PF1/MOD1 code against phenomena expected to occur in a raised-loop B and W plant during a small-break loss-of-coolant accident (SBLOCA). These results show that the code can calculate both single- and two-phase natural circulation, flow interruption, boiler-condenser-mode (BCM) heat transfer, and primary-system refill in a B and W-type geometry with low-elevation auxiliary feedwater. 19 figures, 7 tables.

4734 **(NUREG—0797-Suppl.6) Safety Evaluation Report related to the operation of Comanche Peak Steam Electric Station, Units 1 and 2 (Docket Nos. 50-445 and 50-446).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1984. 252p. NTIS, PC A12/MF A01 - GPO* $6.50. File Number TI85900338.

This supplement reports the status of certain issues that had not been resolved at the time of publication of the Safety Evaluation Report and Supplement 1, 2, 3, and 4 of that report. (Supplement 5, currently in preparation, will document the staff's evaluation findings pertaining solely to an independent design verification, conducted for the applicant by the CYGNA Corporation in late 1983-early 1984, and does not update the status of issues since the release of Supplement 4.)

4735 **(NUREG—0979-Suppl.2) Safety Evalution Report related to the final design approval of the GESSAR II BWR/6 nuclear island design (Docket No. 50-447).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1984. 132p. NTIS, PC A07/MF A01 - GPO* $5.50. File Number TI85900317.

This report supplements the GESSAR II SER (NUREG-0979), issued in April 1983, summarizing the results of the staff's safety review of the GESSAR II BWR/6 nuclear island design. The review is carried out in accordance with the procedures for demonstrating the acceptability of the design for the severe-accident concerns described in draft NUREG-1070, NRC Policy on Future Reactor Designs: Decisions on Severe Accident Issues in Nuclear Power Plant Regulation. Supplement 2 also provides more recent information regarding resolution or update of the confirmatory items and FDA-1 conditions identified in SSER 1. Subject to favorable resolution of the items discussed in this supplement, the staff concludes that the GESSAR II design satisfactorily addresses the severe-accident concerns described in draft NUREG-1070.

4736 **(NUREG—0989-Suppl.1) Safety Evaluation Report related to the operation of River Bend Station (Docket No. 50-458).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1984. 48p. NTIS, PC A03/MF A01 - GPO* $4.50. File Number TI85900312.

Supplement No. 1 to the Safety Evaluation Report on the application filed by Gulf States Utilities Company as applicant and for itself and Cajun Electric Power Cooperative, as owners, for a

license to operate River Bend Station has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status of certain items that had not been resolved at the time of publication of the Safety Evaluation Report.

4737 **(NUREG—1081) Post-accident gas generation from radiolysis of organic materials.** Wing, J. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Sep 1984. 40p. NTIS, PC A03/MF A01 - GPO* $3.75. File Number TI85900250.

This report presents a methodology for estimating the gas generation rates resulting from radiolysis of organic materials in paints and electrical cable insulation inside a nuclear reactor containment building under design basis accident conditions. The methodology was based on absorption of the radiation energies from the post-accident fission products and the assumed gas yields of the irradiated materials. A sample calculation was made using conservative assumptions, plant-specific data of a nuclear power plant, and a radiation source term which took into account the time-dependent release and physico-chemical behavior of the fission products.

4738 **(NUREG—1088-App.A) Technical specifications Limerick Generating Station, Unit No. 1 (Docket No. 50-352). Appendix A to License No. NPF-27.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1984. 512p. NTIS, PC A22/MF A01 - GPO* $10.00. File Number TI85900386.

This appendix includes: definitions, safety limits and limiting safety system settings, limiting conditions for operation and surveillance requirements, bases, design features, and administrative controls. (DLC)

4739 **(NUREG/CR—3675) In-core fuel freezing and plugging experiments: preliminary results of the Sandia TRAN Series I experiments.** McArthur, D.A.; Hayden, N.K.; Mast, P.K. (Sandia National Labs., Albuquerque, NM (USA); Science Applications, Inc., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 140p. (SAND—81-1726). NTIS, PC A07/MF A01 - GPO. File Number TI85003121.

The first series of TRAN experiments, described in this report, was intended to investigate the validity of current freezing models by applying them to a simple situation. The TRAN Series I experiments used pure UO_2 as the molten material, and a simple cylindrical freezing channel to simplify the analysis. Five experiments were performed at different initial channel temperatures. These experiments showed that a conduction-like fuel crust was formed for initial steel temperatures less than 973°K, but much of the crust thickness was composed of a frozen fuel film left behind as the molten fuel slug moved up the channel. In one instance two blockages containing molten steel formed at the leading edge of the flow. Fuel penetration distances intermediate between conduction theory and bulk-freezing theory were observed. A new model embodied in the PLUGM code was developed to describe these low-temperature results. At an initial steel temperature of 1173°K, however, rapid, massive melting of steel was observed, resulting in complex curved interfaces between the fuel and molten steel but with very little entrainment of molten steel into the fuel. Generally longer penetration distances were observed compared to previous models, and the steel-entrainment assumptions of previous models were not verified at these driving pressures; also, important finite-mass effects and liquid-film-deposition effects were inferred from the results.

4740 **(NUREG/CR—3719-R3) Detonation calculations using a modified version of CSQII: examples for hydrogen-air mixtures.** Byers, R.K. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 54p. (SAND—83-2624-R3). NTIS, PC A04/MF A01 - GPO. File Number TI85002955.

CSQ is a well-tested and versatile wave propagation computer program, a modified version of which has been used to perform a number of USNRC-supported analyses of detonations of hydrogen-air mixtures in nuclear reactor containment buildings. The modifications, from a user's viewpoint, are fairly minor, and this version of CSQ is being prepared for release to interested organizations. This report documents the use of CSQ in this form, as well as certain codes which aid in performing the detonation calculations.

4741 **(NUREG/CR—3737) Initial empirical analysis of nuclear power plant organization and its effect on safety performance.** Olson, J.; McLaughlin, S.D.; Osborn, R.N.; Jackson, D.H. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Nov 1984. Contract AC06-76RL01830. 102p. (BHARC—400/84/007; PNL—5102). NTIS, PC A06/MF A01 - GPO $4.75. File Number TI85002490.

This report contains an analysis of the relationship between selected aspects of organizational structure and the safety-related performance of nuclear power plants. The report starts by identifying and operationalizing certain key dimensions of organizational structure that may be expected to be related to plant safety performance. Next, indicators of plant safety performance are created by combining existing performance measures into more reliable indicators. Finally, the indicators of plant safety performance using correlational and discriminant analysis. The overall results show that plants with better developed coordination mechanisms, shorter vertical hierarchies, and a greater number of departments tend to perform more safely.

4742 **(NUREG/CR—4029) Local formulation of interfacial area concentration and its measurements in two-phase flow.** Kataoka, Isao; Ishii, Mamoru; Serizawa, Akimi. (Argonne National Lab., Idaho Falls, ID (USA)). Oct 1984. Contract W-31-109-ENG-38. 70p. (ANL—84-68). NTIS, PC A04/MF A01 - GPO. File Number TI85002517.

The interfacial area concentration is one of the most important parameters in analyzing two-phase flow based on the two-fluid model. The local instantaneous formulation of the interfacial area concentration is introduced here. Based on this formulation, time and spatial averaged interfacial area concentrations are derived, and the local ergodic theorem (the equivalency of the time and spatial averaged values) is obtained for stationary developed two-phase flow. On the other hand, the global ergodic theorem is derived for general two-phase flow. Measurement methods are discussed in detail in relation to the present analysis. The three-probe method, with which local interfacial area concentration can be measured accurately, has been proposed. The one-probe method under some statistical assumptions has also been proposed. In collaboration with the experimental data for the interfacial velocity, radial profiles of the local interfacial area concentration are obtained based on the one-probe method. Result indicates that the local interfacial area concentration has a peak value near the tube wall in bubbly flow, while in slug flow it shows a higher value in the central region of the tube for that particular set of data.

4743 **(PB—84-234848) Pilot study of future research on seismic hazards in Sweden.** Slunga, R. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jul 1984. 56p. (In Swedish). (FOA-C—20544-T1). NTIS, PC E04/MF E01.

The National Defence Research Institute (FOA) has for the last four years studied the southern Swedish seismicity. The possibilities to improve the seismic hazard estimates by achieving knowledge about the relations between the geology, the geophysics and the seismicity is discussed. Both nuclear power plants and nuclear waste disposals are considered. Continued earthquake recording in southern Sweden is proposed, and an extension of the network to the coast of Norrland (very shallow earthquakes) and to Norrbotten (the existance of geophysical maps) is also proposed.

4744 **(PNL—5137) Neutron dosimetry at commercial nuclear plants. Annual report of Subtask D: TEPC feasibility.** Cummings, F.M.; Endres, G.W.R.; McDonald, J.C.; Brackenbush, L.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 127p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84014890.

This study was designed to observe the feasibility of the use by NRC licensees of the tissue equivalent proportional counter (TEPC) system as a neutron monitoring instrument. Laboratory tissue equivalent proportional counters were irradiated using ^{252}Cf sources at NBS and PNL and were irradiated inside containment of four operating nuclear power plants (two boiling water reactors

and two pressurized water reactors). On the average, neutron dose-equivalent rates determined using the TEPC were 1.05 times the calculated dose-equivalent rates for the bare and moderated ^{252}Cf sources and 0.86 times the dose-equivalent rates determined using the multispheres inside containment of nuclear power plants. Further, neutron dose equivalent rates determined using portable remmeters were an average of 1.71 times the dose equivalent determined using the multispheres inside the containment of nuclear power plants. It was observed that while electronic noise from temperature and vibrational effects inside containment prohibited an adequate measure of absorbed dose from gammas, the measurement of neutron absorbed dose was unaffected by these environmental parameters. It is recommended that for use inside containment at nuclear power plants: (1) the laboratory scale TEPC is the superior technique for accurate determination of neutron dose equivalent, (2) for remmeters similar to the one evaluated in this study, neutron dose equivalent response should be corrected to account for dependence of response on neutron energy or the remmeters should be calibrated using a moderated neutron source, and (3) at present, the TEPC should not be used to measure absorbed dose from gammas. Upon the advent of a proven miniaturized TEPC, this instrument may prove to be a desirable replacement for current portable neutron monitoring devices for the determination of dose equivalent inside containment of commercial nuclear power plants.

4745 **(PNL-SA—12038) Effect of input distributions on the probabilistic fracture mechanics analysis of reactor pressure vessels.** Liebetrau, A.M.; Simonen, F.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 21p. (CONF-840647—30). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000832.

From ASME pressure vessel and piping conference; San Antonio, TX, USA (17 Jun 1984).

This paper describes current work whose objective is to improve the stochastic models of variables which affect the fracture mechanics analysis of reactor pressure vessels. The effects of two of the more important variables, the shift in reference temperature for nil ductility transition (ΔRT/sub NDT/) and flaw size, on the probability of vessel failure during a pressurized thermal shock (PTS) incident are studied. Uncertainties in the copper content of weld material have the greatest effect on the variability of simulated values of shift in RT/sub NDT/. The effects of nickel content and fluence are lesser, but significant. These results are inherent in the structural form of the equation used to predict shift. The simulated probabilities of vessel failure are found to vary widely for some of the more popular flaw-depth distributions. Small differences in the way flaw depths are rounded in order to make them compatible with existing simulation codes have profound effects on results. Data on measured flaw lengths are also considered. When length-corrected stress intensity factors are computed for finite-length flaws, simulated failure probabilities decrease. The effect is great enough to justify introducing flaw-length distributions and length-corrected intensity factors into PTS simulation models.

4746 **(PNL-SA—12397) How are things going. Obtaining feedback in a regulatory environment.** McGuire, J.V.; Walsh, M.E.; Boegel, A.J.; Morisseau, D.S.; Persendky, J.J. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 8p. (CONF-8408126—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000367.

From American Phychological Association meeting; Toronto, Canada (24 Aug 1984).

This study tested two procedures to gather feedback for a federal agency about its regulatory actions and its licensees' practices. The procedures, a workshop and a mailed survey, targeted a data source new to the agency. Results to date find the feedback workshop useful and the new data source cooperative and valuable. Participation in the workshops is surprising, given their historical backdrop, structure, and psychological literatures. These findings suggest that agencies may be ignoring important data sources for ill-informed reasons. Also, the findings suggest a possible need to restructure existing channels of communication between a regulatory agency and its licensees.

4747 **(SAND—84-1627C) Evaluation of the use of expert judgment to estimate human error probabilities.** Seaver, D.A.; Comer, M.K.; Stillwell, W.G.; Gaddy, C.D.; Weston, L.M.; Ryan, T.G. (General Physics Corp., Columbia, MD (USA); MAXIMA Corp., Bethesda, MD (USA); Sandia National Labs., Albuquerque, NM (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1984. Contract AC04-76DP00789. 19p. (CONF-8410142—3). NTIS, PC A02. File Number DE84016780.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

As part of a broad research program to develop human reliability data and estimates to support probabilistic risk assessment (PRA), the Nuclear Regulatory Commission has supported a program to develop, test, and evaluate the use of expert judgment to estimate human error probabilities (HEPs). During FY 84, this program conducted an empirical test of previously developed procedures based on psychological scaling. This test evaluated practicality, acceptability, ad usefulness of two specific procedures: paired comparisons and direct numerical estimation. A complete report of this research is provided in NUREG/CR-3688. This paper briefly summarizes the two procedures and how they would be implemented. It then describes the empirical test and its results. The results of this test provided a positive evaluation of the use of expert judgment. Judgments were shown to be consistent and to provide HEP estimates with a good degree of convergent validity. Of the two techniques tested, direct numerical estimation appears to be preferable in terms of ease of application and quality of the results. The fact remains, however, that actual relative frequencies of errors are not available, so predictive validity against such a criterion has not been established. In the absence of such data, and given the practical advantages such as the time and cost of using expert judgment, this approach appears to be a feasible approach to obtaining needed HEP estimates for PRAs or other uses.

4748 **(SAND—84-1764C) Applications of HECTR and MARCON to BWR Mark III and ice-condenser containments.** Dingman, S.E.; Haskin, F.E.; Behr, V.L.; Camp, A.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-8410142—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002441.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

MARCON and HECTR were used to calculate the containment atmosphere pressure and temperature loadings for the CLWG ice condenser standard problem. The calculated peak pressures varied widely due to the variations in the timing of ignition and the amount of zirconium oxidation. The HECTR calculations for the CLWG diffusion flame problem in a Mark III containment were not able to predict detailed results near the flames, but were useful for predicting bulk containment conditions.

4749 **(SAND—84-1768C) Containment Safety Margins Program.** Blejwas, T.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 16p. (CONF-8410142—16). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002446.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The Containment Safety Margins Program is one of three NRC-sponsored programs at Sandia in the area of containment integrity during severe accidents. In this program, models of containment structures with a variety of penetrations and other details are being analyzed and tested by quasi-static pressurization with nitrogen gas. The objective is to qualify methods for predicting the structural behavior and leakage of containments during severe accidents (beyond design basis). The larger models include operable equipment hatches, and the leakage through the hatches is being measured. The distortions of the hatches and of other penetrations are being measured with strain gages and displacement transducers. The strains and displacements near and on the penetrations that are simple representations of actual penetrations, e.g., nonoperable personnel airlock representations, will be used for planning leakage experiments with actual or large-scale penetrations in a companion program entitled Integrity of Containment Penetrations under

Severe Accident Loads. In the third program, entitled Electrical Penetration Assemblies Program, actual electrical penetration assemblies will be pressurized with high temperature steam. The testing to date and planned through the end of FY 1986 is the pneumatic pressurization of models of steel and concrete containments. Although the high temperatures of severe accidents are not modeled in these experiments, they will be included in the penetration tests and seal and gasket tests in the companion programs. Four 1/32 scale models of hybrid steel containments were tested between December 1982 and December 1983. Testing of a 1/8-scale steel model was initiated in September 1984. The conceptual design of a 1/6-scale model of a reinforced concrete containment has been completed; placement of a contract for final design and construction of the model is being negotiated. 6 references, 12 figures.

4750 **(SAND—84-1801C) Containment modeling experiments and analysis.** Subramanian, C.V. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 13p. (CONF-8410142—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000771.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

This paper will provide an overview and status of two of the NRC-funded programs - Integrity of Containment Penetrations Under Severe Accident Conditions (henceforth called Containment Penetrations) program and the Electrical Penetration Assemblies (EPA) program - which are currently in place as a part of the overall effort to evaluate the integrity of containments and the leakage behavior beyond design conditions. Methodology primarily based on experimental investigations will be developed that can be used to provide prediction of leakage behavior through penetrations under severe accident conditions. Pressure, temperature and deformation of the penetration by the containment shell (when found to be significant) will also be considered. The end results from these programs consisting of the leak rate through the penetrations and the analytical methodology should allow the evaluation of containment penetrations under severe accident conditions.

4751 **(SAND—84-1837C) Coolability of UO2 debris beds in pressurized water pools: DCC-1 and DCC-2 experiment results.** Reed, A.W.; Bergeron, E.D.; Boldt, K.R.; Schmidt, T.R. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 18p. (CONF-841174—6). NTIS, PC A02. File Number DE84017005.

From 5. information exchange meeting on debris coolability; Los Angeles, CA, USA (7 Nov 1984).

DCC-1 and DCC-2 (Degraded Core Coolability) have provided the first in-pile data for water-urania dryout heat flux and quench behavior. DCC-1, designed to test the laminar flow region of dryout, has displayed unexpected results. while the dryout fluxes at one atmosphere are approximately those predicted by many of the models, the pressure dependence of the dryout data is predicted by none of the models. The quench behavior of DCC-1 displays none of the fingering observed in out-of-pile experiments. The quench times extend for hours. The DCC-2 dryout data conforms in magnitude and pressure dependence with several of the models. In addition to global dryouts, in which the dry zone extends across the width of the bed, local dryouts were observed. These are zones of lower than average permeability which dry out and achieve stable temperatures without eliminating coolant flow to the bottom of the bed. The quench times in DCC-2 are only a few minutes long. Fingering, modified by the radially varying temperature of the dry particles, was observed.

4752 **(SAND—84-1979C) Nuclear Power Plant Alarm Prioritization using SYSTEM 2000.** Chapman, L.D.; Jones, R.D.; Roscoe, B.J. (Sandia National Labs., Albuquerque, NM (USA)). 1 Oct 1984. Contract AC04-76DP00789. 22p. (CONF-8411114—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000769.

From Association of System 2000 users for technology exchange; Hilton Head, SC, USA (12 Nov 1984).

A SYSTEM 2000 data base is used to organize and facilitate analysis of an annunciator system for a nuclear power plant. A typical annunciator system may contain two thousand annunciators. Each annunciator is represented in the data base by thirteen characteristics which consist of text, coded text, and two dimensional linear arrays. A WANG word processing system was used to prepare the load string for a SYSTEM 2000 data base running on a Control Data Corporation CYBER computer. Application of the data base to annunciator prioritization schemes facilitates determination of those annunciators relevant to each of the plant's ten operating modes. The number and identity of the annunciators affecting each of three defined levels of operator decision and identification of these annunciators can be retrieved from the data base. Plant critical safety function impairment is obtainable from the data base as a function of plant operating modes. 1 reference, 8 figures, 4 tables.

4753 **(SAND—84-2076C) Molten-core coolant interactions program.** Berman, M. (Sandia National Labs., Albuquerque, NM (USA)). 24 Oct 1984. Contract AC04-76DP00789. 22p. (CONF-8410142—32). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002643.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

A great deal of research has been devoted to understanding fuel-coolant interactions that might occur during core-melt accidents. One major objective of this research was evaluation of the probability of direct containment failure due to an in-vessel steam explosion (alpha-mode failure). Other objectives addressed additional consequences of fuel-coolant interactions (FCIs): steam and hydrogen generation rates and magnitudes; post-FCI debris characteristics; and alteration of accident sequences and fission product source terms. This paper briefly discusses our views concerning several methods used for calculating the probability of alpha-mode failure.

4754 **(SAND—84-2077C) Hydrogen deflagrations and diffusion flames.** Berman, M.; Hitchcock, J.T. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 18p. (CONF-8410142—33). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002641.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The Hydrogen Behavior Research Program at Sandia National Laboratories is concerned with the assessment of the threat posed by hydrogen combustion in a nuclear power plant containment. A part of this program addresses the behavior and characteristics of both ordinary deflagrations and diffusion flames, thought to be the most likely modes of combustion during a reactor accident. This paper describes the experimental and modeling work in these areas and reviews the status of the HECTR code.

4755 **(UCID—20247) NRC Seismic Design Margins Program Plan.** Cummings, G.E.; Johnson, J.J.; Budnitz, R.J. (Lawrence Livermore National Lab., CA (USA)). 31 Oct 1984. Contract W-7405-ENG-48. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002808.

The Seismic Design Margins Program (SDMP) discussed in this Plan provides the technical basis for assessing the significance of design margins in terms of overall plant safety and will identify potential weaknesses that might have to be addressed. This, in conjunction with past studies and ongoing validation and fragility efforts, should be effective in resolving the quantification of seismic design margins issues. A general definition of seismic design margin is expressed in terms of how much larger than the design basis earthquake an earthquake must be to compromise plant safety. In this context, margin needs to be defined at the plant, system/function, structure, and component level.

4756 **(UCRL—91681) Seismic Safety Margins Research Program: a concluding look.** Cummings, G.E. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. 19p. (CONF-8410142—12). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000851.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The Seismic Safety Margins Research Program (SSMRP) was started in 1978 with the goal of developing tools and data bases to compute the probability of earthquake - caused radioactive release from commercial nuclear power plants. These tools and

data bases were to help NRC to assess seismic safety at nuclear plants. The methodology to be used was finalized in 1982 and applied to the Zion Nuclear Power Station. The SSMRP will be completed this year with the development of a more simplified method of analysis and a demonstration of its use on Zion. This simplified method is also being applied to a boiling-water-reactor, LaSalle.

4757 **(WINCO—1012) Guidance on offsite emergency radiation measurement systems. Phase 3. Water and non-dairy food pathway.** Salmonson, B.J.; Hoffman, L.G.; Honkus, R.J.; Keller, J.H. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Oct 1984. Contract AC07-84ID12435. 177p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85003202.

This document provides guidance to State and local governments and to federal agencies on offsite emergency measurement of radionuclides in non-dairy food and potable water to determine dose commitment after an accident involving a light-water nuclear power plant. In the early emergency phase of an accident, monitoring of the ingestion pathway should be primarily directed toward controlling the human ingestion of deposited airborne contamination. Ingestion of edible plants is the non-dairy food pathway of primary concern. The importance of this pathway is dependent on the time of year the nuclide release occurs (e.g. deposition of radionuclides on plants just prior to or during harvest presents the greatest hazard). The greatest immediate concern following a release may be from the radioiodines; however, because of their short half-life, the hazard diminishes rapidly and the longer lived radionuclides of strontium and cesium become important. Protective actions and monitoring requirements are discussed. Several alternatives for field monitoring of foodstuffs and water are presented. However, the recommended procedure for monitoring foodstuffs is field sampling in predetermined areas followed by laboratory analyses. The recommended procedure for monitoring water is collection of samples at water purification plants followed by analyses performed by experienced technical personnel. 32 references, 2 figures, 9 tables.

4758 **Double-clad nuclear fuel safety rod.** McCarthy, W.H.; Atcheson, D.B.; Vaidyanathan, S. (to Dept. of Energy). US Patent 4,470,947. 11 Sep 1984. Filed date 30 Dec 1981. vp.

PAT-APPL-335995.

A device for shutting down a nuclear reactor during an undercooling or overpower event, whether or not the reactor's scram system operates properly. This is accomplished by double-clad fuel safety rods positioned at various locations throughout the reactor core, wherein melting of a secondary internal cladding of the rod allows the fuel column therein to shift from the reactor core to place the reactor in a subcritical condition.

4759 **(RISLEY-Trans—4152) Results of damaged cladding tube fuel tests in NSRR experiments.** Tomio, Yoshimura; Masaaki, Ochiai; Toshio, Fujishiro; Michio, Ishijawa. (UKAEA Risley Nuclear Power Development Establishment; Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1984. Translation of JAERI-Memo-8152, 1982. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84901839.

Power reactor fuel elements are kept for long periods under stringent conditions, that is to say in an environment of high temperature, high pressure and high radiation, and therefore defects may occur in some of them as a result of various causes. In order to improve the safety and reliability of atomic reactors it is necessary to have a complete knowledge of the way in which these defective fuel elements will behave in normal operation and also during abnormal transient phenomena and in accidents. Therefore, in the NSRR plan fuel damage tests in regard to defective fuel are planned in conjunction with various kinds of fuel parameter tests; tests regarding waterlogged fuel in which fuel rods are permeated by water, and fuel rods of which the cladding tubes have been damaged, have already been carried out. The present report gives the results of the latter tests regarding damaged cladding tube fuel.

25 ENERGY STORAGE

REFER ALSO TO CITATION(S) 2500004804, 4810

2501 Magnetic

4760 **Generation of a 75-MW 5-kHz pulse train from an inductive energy store.** Honig, E.M. (Los Alamos National Laboratory, Los Alamos, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-12**: No. 1, 24-28(Mar 1984).

The first demonstration of fully controlled high-power high-repetition-rate burst-mode operation of an inductive energy storage and transfer system with nondestructive switches was achieved with fast recovery vacuum switches and a new repetitive transfer circuit. The system delivered a 5-kHz pulse train with a peak power of 75 MW(at 8.6 kA) to a 1-Ω load.

2503 Pumped Hydro

4761 **(TVA/PUB—84/82) Results from transient tests and spherical valve closure tests, Raccoon Mountain Pumped-Storage Plant.** March, P.A. (Tennessee Valley Authority, Norris (USA)). Sep 1984. 118p. NTIS, PC A06/MF A01. File Number DE85900240.

Tests were conducted at the Raccoon Mountain Pumped-Storage Plant to obtain data on hydraulic system characteristics during transient-state operation, to compare measured values for system pressures and surge levels with design values, to provide information for review of hydaulic transient computations, and to provide confirmation that the spherical valves are capable of shutting off plant flow under emergency conditions. The tests included single-unit load rejection, single-unit pump power loss, multi-unit emergency shutdown from generating, multi-unit emergency shutdown from pumping, and spherical valve closure.

2506 Thermal

REFER ALSO TO CITATION(S) 2506004581, 4820

4762 **(AVESTA-PROJ—1983-3) Effect of leaching on the mechanical properties of the gneiss of Avesta.** Roeshoff, K.; Norin, J. (Statens Vattenfallsverk, Vaellingby (Sweden)). 1983. 41p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750232.

The fracture and elastic properties of rock samples during leaching in hot water at 120 C degrees are investigated. Elasticity modulus and stress intensity factors are shown to decrease when leaching time is extended. The analysis has been performed on 35 samples.

4763 **(AVESTA-PROJ—1983-4) Measurement of thermal stresses and deformation of the rock. Stage 1.** Rehbinder, G.; Ingevald, K. (Statens Vattenfallsverk, Vaellingby (Sweden)). 1983. 83p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750233.

The effect of variable temperature on rocks is concentrated to the neigbourhood of the cavern for underground storage of hot water. Stress is dependent on the water temperature and its level is aproximately 5 MPa. The lifting of the ground above the cavern amounts to 1 cm. Higher figures are anticipated after temperature equilibrium has been attained.

4764 **(BFR-R—39-1983) Aquifer system with wells for storage and extraction of heat.** Gustafsson, G. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 181p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. File Number DE85750215.

This report discusses the possibilites for storing and extracting heat from ground water reservoirs through wells, in particular the hydraulic dimensioning of the wells. By examining existing wells in southern Sweden, an evaluated data collection on relations

between particle parameters and permeability and porosity has been established. A statistical treatment has given information on the precision of the evaluated data. Literature and field studies of infiltration wells have been made. Causes for blockage of infiltration wells are discussed in the report. The hydraulic and thermal contact between the infiltration and extraction wells is also discussed, and advice is given concerning the design of a circulation system with wells.

4765 **(BMFT-FB-T—84-100) Long-time heat storage prototype Wolfsburg. Stage 1 - Planning phase.** Strickrodt, J.; Breuer, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752270.

The purpose of the project was to plan two earth storages with a volume of 10.000 m^3 each. The results should be transferable to large-scale stores until a capacity of some millions m^3. The engineering has been carried out under the co-operation of several institutes of technology, public material testing laboratories, and private engineering offices. The building conception has been worked out, the construction developed in details and the materials successfully tested in long-time investigations. The result of the planning is, that a long-time heat storage is technically feasible today. On the basic of the public announcement a cost function, which describes the decreasing of the specific building expenses, has been given for the realization of large-scale storages.

4766 **(N—84-25170) Development of media for dynamic latent heat storage for the low temperature range. Part 1: Thermal analysis of selected salt hydrate systems.** Kanwischer, H.; Tamme, R. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.)). Dec 1983. 76p. (DFVLR-FB—84-03-PT-1). NTIS, PC A05/MF A01.

Phase change temperatures and phase change enthalpies of seventeen salt hydrates, three double salts, and four eutectics were measured thermodynamically and the results reported herein. Good results were obtained, especially for congruently melting salt hydrates. Incongruently melting salt hydrates appear less suitable for heat storage applications. The influence of the second phase - water, acid, and hydroxide - to the latent heat is described. From these results, basic values of the working temperatures and storage capabilities of various storage media compositions may be derived.

4767 **(N—84-28206) Sensible heat storage in water.** Harmsworth, B. (Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (UK)). 1983. 19p. (PP—132). Elliott-Automation Space and Advanced Military Systems Ltd., Camberley (England).

Cost and performance models for heat storage in water, to derive the optimum store characteristics in terms of cost to meet certain simulated loads are described. Waste heat recovery applications are found to be cost effective for a wide range of store types with payback periods 1 yr. For solar applications the range of suitable stores is greatly reduced in the case of a diurnal store and only large scale Earth retained membrane lined stores may be cost effective for interseasonal cycle application. The extent of potential sensible heat storage applications is discussed with regard to the financial, resource and infrastructure requirements necessary for thermal stores to be cost effective in meeting the energy demand patterns of the industrial, commercial and residential sectors. (ESA)

2508 Chemical

REFER ALSO TO CITATION(S) 2508004453, 4853

2509 Batteries

REFER ALSO TO CITATION(S) 2509004605, 4974, 5054

4768 **(LBL—18103) Chemistry and status of rechargeable molten-salt batteries.** Cairns, E.J.; Mamantov, G.; Tischer, R.P.; Vissers, D.R. (Lawrence Berkeley Lab., CA (USA); Tennessee Univ., Knoxville (USA); Ford Motor Co., Dearborn, MI (USA); Argonne National Lab., IL (USA)). May 1983. Contract AC03-76SF00098. 19p. (CONF-830508—30). NTIS, PC A02. File Number DE85001647.

From 163. Electrochemical Society meeting; San Francisco, CA, USA (8 May 1983).

The chemistry and the state of development of rechargeable molten salt cells and batteries of current interest are reviewed in this report.

4769 **(NP—5770015) Development, construction and testing of a charge state-indicator for lead batteries in electric-drive road vehicles.** Schleuter, W.; Steffens, W. (Forschungsvereinigung Automobiltechnik e.V., Frankfurt-am-Main (Germany, F.R.)). May 1983. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85770015.

The device indicates the residual charge stored in the battery. It functions according to the principle of charge measurement while taking into account the average rate of discharge and the electrolyte temperature. It is suitable for application in electric-drive vehicles equipped with lead batteries. At first, the article gives a definition of charge state and a description of its influencing parameters and methods for their determination. Next, the various demands made on a charge state indicator [CSI] are compiled in a charge record. Then, the CSI developed is explained by means of diagrams followed by a detailed description of individual components by means of connections and error/failure graphs. The operation of the device is demonstrated by means of measurement results obtained with a number of drives of an electric transporter at different loads.

4770 **The effects of water on the cathode passivation by lithium dithionite in the Li/SO_2 battery.** Whiteley, R.V.; Blasi, J.A. (Sandia National Laboratories, Albuquerque, NM). *Proceedings - Electrochemical Society;* **84-1**: 244-254(Oct 1983). (CONF-831086—).

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

The electrochemical reduction of SO_2 from a LiBr/acetonitrile solution leads to the formation of a passivating lithium dithionite ($Li_2S_2O_4$) film on the cathode. The passivation of a glassy carbon electrode can be enhanced by adding alkaline materials (e.g., Li_2CO_3) to the electrolyte. Conversely, when water (>100 ppm) is added to the system, the effects of the dithionite film are diminished. Although the passivation of the cathode is observed for the electroreduction of dilute (<10 mM) as well as concentrated (>1M) SO_2 solutions, the depassivation of the film by water is observed only when water is added to a concentrated electrolyte solution. Multiple scan cyclic voltammetry has been used to monitor the extent of cathode passivation as a function of water content (<1000 ppm). Several mechanisms for the apparent depassivation are postulated, and each is addressed using chronoamperometry and cyclic chronocoulmetry. It has been concluded that the water in the electrolyte increases the conductivity of the dithionite film.

4771 **Lithium cycling in sulfolane-based electrolytes.** Foos, J.S.; Rembetsy, L.M. (EIC Laboratories Inc., Newton, MA). *Proceedings - Electrochemical Society;* **84-1**: 413-421(Oct 1983). (CONF-831086—).

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

The use of sulfolane as a solvent for electrolytes in secondary lithium batteries has been investigated. The electrolyte solutions examined are moderately conductive and show excellent stability towards lithium at 70°C. Sulfolane/$LiClO_4$ electrolyte allows the cycling of lithium at up to 88% efficiency at 90°C in half-cells. The purification of sulfolane is discussed.

4772 **The use of lithium aluminum chloride molten salt as an electrolyte in lithium cells.** Raistrick, I.D.; Huggins, R.A. (Department of Materials Science & Engineering, Stanford University, Stanford, CA). *Proceedings - Electrochemical Society;* **84-2**: 82-89(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Although lithium aluminum chloride, either as a molten salt or as a solid, is unstable to reduction by lithium at high activities, it is stable to elemental aluminum. It is therefore possible to construct cells with an aluminum negative electrode and a positive electrode reversible to lithium. The thermodynamics of such a system have been examined, and the kinetic behavior of the aluminum electrode investigated in melts of two different compositions. In addition, two lithium vanadium oxides have been tested as possible positive electrode materials.

4773 **The chemistry and status of rechargeable molten-salt batteries.** Cairns, E.J.; Mamantov, G.; Tischer, R.P.; Vissers, D.R. (Univ. of California, Berkeley, CA). *Proceedings - Electrochemical Society;* **84-2**: 284-312(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The chemistry and the state of development of rechargeable molten salt cells and batteries of current interest are reviewed in this work. Molten-salt cells offer the most attractive combination of high specific energy (100-200 Wh/kg), high specific power (50-200 W/kg), and long cycle life (300-1500 cycles) of any rechargeable cells under investigation at this time. It is these important features that justify the development and application of cells that have the disadvantages of operation at elevated temperatures, and difficult materials problems. There are two major categories of molten-salt cells: those in which the molten salt is the sole electrolyte, and those in which the molten salt serves as a reactant and as an auxiliary electrolyte (the main electrolyte is a solid). In the first category are such cells as LiAl/LiCl-KCl/FeS, LiAl/LiCl-KCl/FeS_2, and Li_4Si/LiCl-KCl/FeS_2; in the second category are Na/Na_2O . xAl_2O_3/Na_2S /SUB n/ -S, Na/Na^+ glass/Na_2S /SUB n/ -S, Na/Na_2O . xAl_2O_3/SCl_3AlCl_4 in NaCl-$AlCl_3$, and $Li/Li_2O/LiNO_3$-KNO_3/V_2O_5. These cells have operating temperatures ranging from 150 to 475°C, and all must be sealed from the atmosphere because of the alkali metal reactants and hydrolytic degradation of molten salt electrolytes.

4774 **Nitrite molten salt for use in intermediate temperature lithium cells.** Poris, J.; Huggins, R.A.; Raistrick, I.D. (Department of Materials Science and Engineering, Stanford University, Stanford, CA). *Proceedings - Electrochemical Society;* **84-2**: 313-321(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The $LiNO_3$-KNO_3 (40-50 m/o) molten salt, which melts at 120°C, has been employed as an electrolyte in intermediate temperature lithium cells. The behavior of solid lithium in this electrolyte is analogous to the behavior of lithium in the similar intermediate temperature alkali nitrate electrolyte. Lithium reacts with the melt to form a thin, lithium ion conducting, protective layer which is believed to be Li_2O. The electrolyte is electrochemically reduced below 1.9 volts versus Li^+/Li, and is oxidized to lithium metal and NO_2 gas above 3.5 volts versus Li^+/Li. This electrolyte can be used in secondary cells with lithium or high lithium activity negative electrodes, and lower lithium activity positive electrodes which react reversibly with lithium. The resistance of the protective layer on lithium increases with time as the thickness increases. Its resistance is of the order of 1-10 ohms after 10 hours at 150°C.

4775 **Thermal behavior of the potassium-sulfur electrolyte.** Junz, G.J.; Rogers, D.J. (Cogswell Laboratory, Rensselaer Polytechnic Institute, Troy, NY). *Proceedings - Electrochemical Society;* **84-2**: 322-334(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

Enthalpy of fusion and heat capacity data are reported for the compositions: di-, tri-, tetra-, penta-, and hexapolysulfides. Pronounced glass forming tendencies on cooling from the molten state are observed in the region of about 62 to about 67 wt% sulfur; this composition range is also characterized by inverse crystallization phenomena, much as observed in the closely related sodium-sulfur system. The calorimetric studies were extended to compositions in the region of liquid-liquid immiscibility, and the behavioral aspects are also reported.

4776 **Solubility of Li_2S in LiF-LiCl-LiBr electrolyte measurements and calculations.** Tomczuk, Z.; Saboungi, M.L.; Vissers, D.R. (Argonne National Laboratory, Chemical Technology Division, Argonne, Illinois). *Proceedings - Electrochemical Society;* **84-2**: 352-358(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The solubility of Li_2S in LiF-LiCl-LiBr electrolyte was determined at 739 and 773 K, by measuring the change in the emf of the Li-Al/Ni_3S_2 couple as the Li_2S concentration was changed in the electrolyte. The measured solubility values were 6840 + or - 300 ppm at 739 K and were 8700 + or - 300 ppm at 773 K. The Li_2S solubilities in different solvents have been calculated using the conformal ionic solution theory. The computed values are in very good agreement with experiments and confirm the strong dependence of the solubility on the composition.

4777 **Measurements of the partial electronic conductivity in lithium chloride - potassium chloride molten salts.** Reynolds, G.J.; Huggins, R.A.; Lee, M.C.Y. (Department of Materials Science and Engineering, Stanford University, Stanford, CA). *Proceedings - Electrochemical Society;* **84-2**: 519-533(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The partial electronic conductivity of the lithium chloride-potassium chloride eutectic molten salt electrolyte has been studied as a function of lithium activity, temperature and melt composition using the Wagner asymmetric d-c polarization technique. Measurements were made over the temperature range 383-465°C and at lithium activities extending from 1.95 X 10^{-7} to unity. The results confirmed the applicability of this technique to molten salt systems. The partial electronic conductivity was shown to be much greater than the partial hole conductivity over the range of lithium activities investigated, and was found to increase monotonically with temperature and lithium activity, but decreased on addition of excess LiCl to the eutectic composition. Approximate values of self-discharge currents for cells utilizing an "Al/LiAl" negative electrode and a LiCl-KCl molten salt electrolyte have been calculated.

4778 **Cell design principles for the measurement of kinetics of fast electrode reactions.** Nagy, Z.; Settle, J.L. (Argonne National Laboratory, Chemical Technology Division, Argonne, Illinois). *Proceedings - Electrochemical Society;* **84-2**: 534-544(May 1983). (CONF-8305100—).

From 4. Electrochemical Society international symposium on molten salts; San Francisco, CA, USA (8 May 1983).

The rates of electrode processes in high temperature molten salts are often very fast and special precautions are needed in their measurement. The measurement methods are invariably some sort of relaxation technique where a fast perturbation of the current (or the potential) is applied and the resulting potential (or current) relaxation is recorded. The measuring cells used in these experiments have to be carefully designed so that the distortion of the fast electrical signals and the introduction of spurious signals are avoided. The two requirements of a good cell design can be simply stated as (i) the assurance of uniform current distribution on the working

electrode surface and (ii) small impedance. The latter requirement includes small stray capacitances and small inductances, which is necessary to avoid detrimental phase shifts and inductive spikes in the signal. In addition, one requires a small ohmic resistance of the solution between the reference and the working electrodes. Three cell designs, aimed at fulfilling these requirements, are described.

29 ENERGY PLANNING AND POLICY

4779 **(SOU—1983-19) Great transition. An analysis of international energy markets.** (Industridepartementet, Stockholm (Sweden)). 1983. 340p. (In Swedish). NTIS (US Sales Only), PC A15/MF A01. File Number DE85750218.

In the beginning of 1981, the Swedish government appointed Carl Tham, former Minister of Energy and currently Director of the National Energy Administration, to explore the development of the international energy markets, with special reference to the impact on conditions for Swedish energy supply. The energy market investigation does not claim to make any forecasts for the future. Instead, its analytical structure presents the political and economic environments which affect energy decisions by both producers and consumers, coupled with assessments and forecasts of the future energy situation as seen by other sources. The investigation is primarily concerned with oil, although gas and coal are by no means ignored.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 2901004800

4780 **(DOE/EIA—0226(81/12)) Electric Power Monthly, December 1981.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 16 Mar 1982. 157p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE85002296.

The electric power monthly is designed to provide information about electric power production and consumption in a concise format to satisfy the needs of a wide variety of audiences. This publication is geared to applications by electric utilities, industry, consumers, educational institutions, and government in recognition of the growing importance of energy planning in a contemporary society. The electric power monthly presents monthly summaries of electric utility statistics at the national, regional, State, or local levels on the following subjects: stocks (fuel); receipts (fuel); consumption (fuel); net generation; Net energy for load; peak load and net capability; cost (fuel receipts); retail prices; sales, revenue, and income. The publication covers each of these subjects in a separate chapter. Chapters on stocks, receipts, consumption, and net generation present data first for the total United States, followed by data summaries at the regional level and the State level. The chapter on sales, revenue, and income of electric utility companies presents United States totals, followed by State data. Chapters on net energy for load, and peak load and net capability present United States' totals first, followed by ragional data. The chapter on cost provides national averages followed by State averages, while the neratonhapter on retail prices presents United States average followed by local averages. Each chapter contains related text, tables, or graphs.

4781 **(K/D—5590) Management challenges encountered in CAD implementation.** Cannon, D.D.; Kahl, K.G. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1984. Contract AC05-84OT21400. 12p. (CONF-8408125—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002072.

From American Society of Engineering Management national meeting; Dallas, TX, USA (20 Aug 1984).

Implementation of a Computer-Aided Design System in a design engineering organization involves a number of challenges that range from selling the acquisition to both management and the design staff to solving communication problems between unlike hardware and software systems. Many of the challenges are managerial in nature and even the technical challenges require management skills if they are to be effectively mastered. The challenges could become a deterrent to progress if one elects to wait until completely satisfactory approaches are developed which provide all the answers in advance. Reasonable progress requires some risk taking and use of multiple approaches and contingency plans. The dynamic nature of CAD technology can easily render the basis for many initial decisions invalid before they can be implemented. Hopefully, most decisions will be good even if their basis proves invalid. Prudence in system selection, tempered early expectations, and considerable patience are required to survive. Perserverance is a must if the ultimate objective is to be reached.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 2902004287, 4288, 4307, 4807, 4811, 5420, 5435

4782 **(DOE/EI/02295—T3) Federal aid to energy impacted communities. A review of related programs and legislative proposals.** Brody, S.E. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. of Architecture and Planning). May 1977. Contract AM01-76EI02295. 62p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85002884.

This evaluation of federal impact assistance programs attempts to clarify the underlying objectives of federal aid and to review the administrative strategies of a range of programs. The design of effective programs depends on a clear statement of objectives and a thorough consideration of the most appropriate form of assistance.

4783 **(DOE/EI/02295—T4) Predicting the local impacts of energy development: a critical guide to forecasting methods and models.** Sanderson, D.; O'Hare, M. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. of Architecture and Planning). May 1977. Contract AM01-76EI02295. 108p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85003085.

Models forecasting second-order impacts from energy development vary in their methodology, output, assumptions, and quality. As a rough dichotomy, they either simulate community development over time or combine various submodels providing community snapshots at selected points in time. Using one or more methods - input/output models, gravity models, econometric models, cohort-survival models, or coefficient models - they estimate energy-development-stimulated employment, population, public and private service needs, and government revenues and expenditures at some future time (ranging from annual to average year predictions) and for different governmental jurisdictions (municipal, county, state, etc.). Underlying assumptions often conflict, reflecting their different sources - historical data, comparative data, surveys, and judgments about future conditions. Model quality, measured by special features, tests, exportability and usefulness to policy-makers, reveals careful and thorough work in some cases and hurried operations with insufficient in-depth analysis in others.

4784 **(DOE/EIA—0147(81/10)) Energy data report: Sales, Revenue, and Income of Electric Utilities. Monthly report, October 1981.** Woods, T.F. (USDOE Energy Information Administration, Washington, DC). 19 Jan 1982. 3p. NTIS, PC A02/MF A01; 1 - GPO; GPO Dep. File Number DE85002269.

This is the last issue of Sales, Revenue, and Income of Electric Utilities. The data contained in this report are being published in Section 10 of the Electric Power Monthly.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 2903004711, 4807, 5304, 5331, 5355

4785 **(CONF-830669—) Proceedings of the DOE/industry workshop on the interactions of climate and energy.** MacCracken, M.C.; Moses, H.; Knox, J.B. (eds.). (Lawrence Livermore National Lab., CA (USA)). Jul 1984. Contract W-7405-ENG-48. 268p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85001471.

From DOE/industry workshop on the interactions of climate and energy; Harpers Ferry, WV, USA (6 Jun 1983).

This proceedings volume reports on the findings and recommendations of the joint Industry/DOE Workshop on the Interac-

tions of Climate and Energy, which was designed to bring the providers of climate information and services together with users and representatives of the oil, gas, coal, and electric utility sectors of the US energy industry. Primary discussion topics included current uses of climate data, the perceived impacts of climatic anomalies on the energy sector, ways to improve the uses of climate data, and recommendations for future research by the climate community. Papers have been individually abstracted.

4786 **(CONF-840180—Summ.) Report on the Second Annual Review Meeting of the National Acid Precipitation Assessment Program. Research to assist decisionmaking. Summary.** (Interagency Task Force on Acid Precipitation, Washington, DC (USA)). 1984. 80p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85003003.

From 2. annual review meeting of the National Acid Precipitation Assessment Program; Frederick, MD, USA (31 Jan 1984).

The second annual meeting of the National Acid Precipitation Assessment Program (NAPAP) was held on January 31 and February 1, 1984, in Frederick, Maryland. The theme for the meeting was Research to Assist Decisionmaking. The purpose was to enhance the dialogue between decisionmakers and the scientific community regarding the information needed by decisionmakers and the information research can provide. Discussion focused on the significance of current data and gaps, priorities for research and improving the communication of results. This report summarizes the discussions and major recommendations of the meeting.

4787 **(DOE/EV/10720—T1) Summary of tasks on NEPA documentation for DOE Office of Environmental Compliance. Final report.** (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). 1984. Contract AC01-81EV10720. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002627.

The tasks assigned under contract to the DOE Office of Environmental Compliance (OEC) are briefly summarized. They include: (1) modify OEC's NEPA document tracking system (NATS); (2) provide bi-weekly updates of information on DOE NEPA documents using revised NAT System; (3) review and update OEC's NEPA document distribution system; (4) NEPA compliance, scoping, and hearing documents; (5) calendar of events and abstracts; (6) library of DOE NEPA documents; (7) NEPA compliance tracking; (8) NEPA document schedule; (9) update OEC's NEPA distribution system; (10) provide special indices and inventories for OEC; and (11) continue providing technical support to OEC. (ACR)

4788 **(TVA/ONRED/EQS—84/1) Environmental research and development: issues and needs, 1985-1990.** (Tennessee Valley Authority, Knoxville (USA). Environmental Research and Development Staff). 1984. 14p. NTIS, PC A02/MF A01. File Number DE85900231.

This report identifies the major concerns and challenges expected to be associated with TVA's energy, natural resources, economic, and fertilizer development programs between 1985 and 1990, and it recommends priorities for research and development initiatives to address these concerns. Needs are identified in relation to five environmental issues: acid deposition, air emissions, groundwater, solid and hazardous wastes, and surface water.

4789 **Management challenges and responsibilities.** Thomas, B. (Union Carbide Corp., Nuclear Division, Oak Ridge, TN). pp 19-20 of Shaping our energy future. Knoxville, TN, USA; LTM Consultants (1984). (CONF-840229—).

From 11. annual WATTec conference and exposition - shaping our energy future; Knoxville, TN, USA (21 Feb 1984).

Abstract only.

Employee safety must start with upper management and must permeate through the organization with the supervisor and the employee being an integral part of the system. Each of the system parts must share in the ownership of employee safety in striving to provide a quality of life that is free from harm and protected. Management must delegate responsibility for health and safety, yet never relinquish ultimate responsibility. When the safety program system breaks, management is in the position to fix it. For system repairs and improvements, the resources of the organization and active participation with health and safety specialists must be committed by management. It is recognized that the front line supervisor is a key in accident prevention for it is the supervisor who influences the translation of management policy to safety actions. However, to be effective the safety program must be led by upper management and transmitted through the total management team undiminished. Management's challenges and responsibilities are to establish the safety program and the working environment which promotes each individual to strive for improving the safety program by actions and attitudes. The components of the program are preplanning, job observation, safety investigations, innoivations, and teamwork.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 2905004200, 4285, 4427

4790 **(HEDL—7481) Quality assurance handbook for measurement laboratories.** Delvin, W.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76FF02170. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002636.

This handbook provides guidance in the application of quality assurance to measurement activities. It is intended to help those persons making measurements in applying quality assurance to their work activities by showing how laboratory practices and quality assurance requirements are integrated to provide control within those activities. The use of the guidance found in this handbook should help provide consistency in the interpretation of quality assurance requirements across all types of measurement laboratories. This handbook also can assist quality assurance personnel in understanding the relationships between laboratory practices and quality assurance requirements. The handbook is composed of three chapters and several appendices. Basic guidance is provided by the three chapters. In Chapter 1, the role of quality assurance in obtaining quality data and the importance of such data are discussed. Chapter 2 presents the elements of laboratory quality assurance in terms of practices that can be used in controlling work activities to assure the acquisition of quality data. Chapter 3 discusses the implementation of laboratory quality assurance. The appendices provide supplemental information to give the users a better understanding of the following: what is quality assurance; why quality assurance is required; where quality assurance requirements come from; how those requirements are interpreted for application to laboratory operations; how the elements of laboratory quality assurance relate to various laboratory activities; and how a quality assurance program can be developed.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 2906004355, 4362, 4389, 4635, 4711

4791 **(OTA-E—216) Nuclear power in an age of uncertainty.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Feb 1984. 300p. GPO. File Number TI84901923.

The present nuclear era is drawing to a close. Unit 1 of the Washington Public Power Supply System was indefinitely, perhaps permanently, deferred even though it was 60% complete and $2.1 billion had been invested. This plant and others such as Zimmer and Marble Hill epitomize the difficulties facing the nuclear industry. It is important to remember, however, that other nuclear plants have been very successful and produce reliable, low cost electricity. The future of nuclear power poses a complex dilemma of policymakers. It has advantages that may prove crucial to this nation's energy system in the coming decades, but at present it is an option that no electric utility would seriously consider. OTA examined questions of demand growth, costs, regulation, and public acceptance to evaluate how these factors affect nuclear power's future. We reviewed research directions which could improve conventional light water reactor technology and opportunities to develop

other types of reactor concepts that might enhance safe and reliable operation. In addition, the crucial role of utility management in constructing and operating nuclear powerplants is examined at length. The controversy about nuclear safety regulation is also analyzed, and is presented with a review of current proposals for regulatory reform. Finally, the study discusses policy approaches that could assist a revival of the nuclear option should that be a choice of Congress.

4792 **Fiscal year 1985 Department of Energy authorization (nuclear fission R and D and waste management). Volume IV. Hearings before the Subcommittee on Energy Research and Production of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, Second Session, February 7, 8, 9, 1984.** Washington, DC, USA; Government Printing Office (1984). 1112p.

Volume IV of the DOE authorization hearings covers material relating to research and development on nuclear fission and on waste management during three days of testimony. The 29 witnesses included nuclear scientists in both the private and public sector, as well as specialists in energy policy, electric power, and the nuclear industry. Among the issues covered were the distribution of resources for nuclear research to ensure the development of innovative technology, problems within the nuclear industry, regulatory reform, the progress on spent fuel research and development, and funding for the light water reactor extended burnup program. Chairman Lloyd noted the problems associated with a 50% decline in federal funding during the Reagan administration. An appendix with supplemental questions and answers for the record follows the testimony.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 2907004795

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 2908004856

4793 **(BMFT-FB-T—84-156) Full supply of heating energy for Erlangen.** Paul, M.; Dyck, A. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE84752280.

The full supply of heating energy of an average town including heat uncoupling from a supraregional superpower station with the town of Erlangen serving as an example is investigated. The planned expansion of GROSSKRAFTWERK FRANKEN II (Superpower Station Franken II), which is situated close by the town, by a 750 megawatt pit coal block would open a tremendous heat potential to the ERLANGER STADTWERKE AG (Erlangen Public Utilities). 350 megawatt of long-distance heating energy could be utilized additionally, if it could be sold at the Erlangen heating-energy market. Heat-potential analyses and substitution as well as investment plannings showed that the project is technically and economically feasible, the following criteria being of special importance: 1. the heat price ex superpower station (evaluation of loss of electric current), 2. issue of project financing (about 400 million DM with in 15 years), and 3. suitable marketing activities for the purpose of obtaining a high degree of connection.

4794 **(IVA—252) District heating for the future. Documentation from a IVA symposium in Stockholm the 28th April 1983.** (Ingenjoersvetenskapsakademien, Stockholm (Sweden)). 1983. 163p. (In Swedish, English). (CONF-8304204—). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750212.

From IVA symposium on district heating for the future; Stockholm, Sweden (28 Apr 1983).

District Heating for the Future is a report containing the lectures given at a Symposium on April 28, 1983. It was arranged by the Royal Swedish Academy of Engineering Sciences (IVA) in cooperation with the Swedish Council for Building Research (BFR). Lately, district heating has expanded rapidly and Sweden has thus gathered high technological competence in this area. Present energy policy recommends that this expansion be continued as part of Sweden's efforts to reduce her dependence on oil. What will future district heating technology look like? Are we to experience a fast introduction of new energy sources in district heating systems or shall we go on building such plants in the traditioanal way? Where is the market for district heating industry and consultants to be situated and what structure will it have? These issues were all penetrated at the Symposium.

4795 **(NP—5770019) Thermal insulation of vacuum-steel-jacket tubes for district heating.** Deimling, A. (Dortmund Univ. (Germany, F.R.). Abt. Chemietechnik). 1 Jun 1983. 210p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85770019.

The theoretical part deals with the pressure dependence of the effective heat conductivity of porous insulation materials (fibre insulating shells, perlite insulating powder). The experimental part concerns studies on the impacts of pressure and temperature on a pipe unit and a plate unit. These show a decrease of effective heat conductivity in the pressure range of 10 to 0.1 mbar or else with smaller fibre distance and finer-sized powder particles. Measurement values can be well demonstrated by physico-empirical model. The Smolukhovski effect is employed.

2910 Conservation

REFER ALSO TO CITATION(S) 2910004763

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 2930004389, 4792, 4802, 5331

4796 **(ANL/CNSV-TM—139) Problems in implementing energy programs in selected United States communities.** Kron, N.F. Jr.; Randolph, J. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002602.

Annex 7 of the International Energy Agreement on Buildings and Community Systems is designed to promote exchange of energy information and ideas between the four participating countries. Element 2 of Subtask D within Annex 7 consists of a systematic evaluation of the content of local energy programs. This report provides Annex 7 participants with more information on the contents of implemented local energy programs in the United States. Although the three focus communities of the Subtask C and D studies are discussed here as well, this report emphasizes a wide range of implemented projects, using many community examples. The bulk of this report is taken from a conference paper that, discusses existing local implementation projects. A number of regulatory, incentive, and financing projects, representing a broad range of such programs, are described briefly. Developments that have occurred since the preparation of the conference paper are noted. Problems in program implementation are identified, in accordance with the task description of Element 2 of Subtask D. The difficulties encountered in coordinating many individual projects as a consistent program are considered of special concern.

4797 **(ANL/CNSV-TM—142) Potential solutions to problems in local energy planning.** Kron, N.F. Jr.; Meshenberg, M.J. (Argonne National Lab., IL (USA)). Sep 1983. Contract W-31-109-ENG-38. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85002601.

The Annex 7 Agreement of the International Energy Agency is designed to promote exchange of information on local government energy projects among the participating countries: West Germany, Italy, Sweden, and the United States. Subtask C within Annex 7 describes, evaluates, and recommends improvements in the energy management processes established by local governments. The work plan for Subtask C has four elements, the first three of which are being undertaken individually by each country; description of the existing energy planning and management activities and procedures of local governments; evaluation of these activities and procedures, in order to identify problems in legal powers, organization, decision making, and implementation;

identification of potential solutions in those four problem areas, illustrated by examples from local communities, and adaptation of the potential solutions for application in focus communities; and cross-country comparisons, a comprehensive review of activities in all participating countries. The comparison will be completed by the United States, which has been designated lead country for Subtask C. The report is concerned with the third element of Subtask C, and covers the continuation of the work done in Elements 1 and 2. Of these, Element 2 concerning problems in four areas, is most relevant. Three focus communities, as well as other localities, were used to provide examples of problems. In Element 3, potential solutions to the problems identified in Element 2 have been documented, and specific community examples are used as appropriate. The last section of this report describes the adaptation of the potential solutions to use in the focus communities. The US approach has been to formulate a short, hypothetical plan (or strategy) that could be followed by each focus community.

4798 **(ORNL/Sub—7317/3) Follow-up cogeneration institutional study in the Geismar, Louisiana and Orange, Texas areas.** (Stone and Webster Management Consultants, Inc., New York (USA)). Sep 1981. Contract AC05-84OR21400. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85000419.

The passage of regulations implementing the National Energy Act of 1978 is the major change in the regulatory environment. The major objective of this study is to determine the extent to which these regulations have affected the various parties to a cogeneration project. The technical and financial aspects of cogeneration were not reevaluated, but interviews were conducted with federal and state government officials, industrial energy users and the local utilities to get a better understanding of their current institutional problems. This follow-up study investigates the history of regulatory and other activities since the previous study. A summary is presented of regulations enacted regarding the National Energy Act, as well as other government actions such as tax legislation. Known actions of industry and the utilities are also summarized. This study reports in detail on the perceptions of industry, utility, and regulatory bodies on the economics and viability of cogeneration in the new political and regulatory climate.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 2940004200, 4273, 4273, 4274, 4274, 4285, 4287, 4288, 4289, 4289, 4307, 4308, 4785, 4785, 4785, 5420

4799 (EUR—9126-d,e,f, pp 2-10) **Coal policy in the European Community.** Reichert, K. 1984. European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037. (CONF-8311207—).

From Symposium on roadway drivage techniques in the coal mines of the European Community; Luxembourg, Luxembourg (9 Nov 1983).

This paper is a general introduction to the conference. Energy policy objectives in the European Community are discussed. There is a need for governments of member states to maintain a process of restructuring of policies in changing economic circumstances. A five year programme (1984-88) for funding of energy projects by the Community has been proposed. Consumption of coking coal and steam coal are discussed. Policies to promote the greater use of solid fuel, and research and development programmes for combustion and conversion, are described.

4800 **The application of adjoint sensitivity theory to a liquid fuels supply model.** Alsmiller, R.G.; Barhen, J.; Drischler, J.D.; Horwedel, J.E.; Lucius, J.L. (Oak Ridge National Laboratory, Oak Ridge, TN). *Energy (Oxford);* 9: No. 3, 239-253(Mar 1984).

Adjoint sensitivity theory has been applied to a liquid fuels supply model to determine the sensitivity of calculated results to the parameters in the model. The power of the adjoint sensitivity methodology is that it provides, in principle, an efficient means of calculating the sensitivity, dR/dx, of any calculated result R to every parameter x in the model. The liquid fuel supply model considered is one of a class of models that may be constructed from the Generalized Equilibrium Modeling System (GEMS) developed at Decision Focus, Inc., Los Altos, California. It is shown that for this class of models the lengthy development effort that is usually associated with applying the adjoint sensitivity methodology can be avoided by using the GEMS program to evaluate the large number of partial derivatives that are needed to apply the methodology.

2960 Electric Power

REFER ALSO TO CITATION(S) 2960004785

4801 **(DOE/EIA—0397(84/2Q)) Electric Power Quarterly, April-June 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Oct 1984. 310p. NTIS, PC A14/MF A01; 1 - GPO; GPO Dep. File Number DE85002366.

The Electric Power Quarterly is prepared by the Electric Power Division; Office of Coal, Nuclear, Electric and Alternate Fuels; Energy Information Administration; US Department of Energy. The Electric Power Quarterly is designed to provide energy decisionmakers with accurate and timely generation and fuel cost and quality information on a plant-by-plant basis. This publication is designed for applications by electric utilities, fuel suppliers, consumers, educational institutions, and government in recognition of the growing importance of energy planning in a contemporary society. The Electric Power Quarterly presents monthly summaries of electric utility statistics at the national, divisional, State, company, and plant levels on the following subjects: Quantity of Fuel, Cost of Fuel, Quality of Fuel, Net Generation, Fuel Consumption, and Fuel Stocks.

4802 **(EFN—4) New technics for the production of electricity - use of electricity. Investigation for the energy committee of the year 1981.** (Energiforskningsnaemnden, Stockholm (Sweden)). Oct 1983. 249p. (In Swedish). (DS-I—1983:21). NTIS (US Sales Only), PC A11/MF A01. File Number DE85750214.

The report presents a survey of that type of new technology which is assumed to be demonstrated by 1990 and will begin to become competitive by 2000 at the latest. The economic conditions for the introduction of new methods for the production and use of electric power are discussed. The supply of energy is anticipated to emanate from large scale electric power production by coal-fired plants. A minor part of electric power will be produced by wind power, solar cells and wave power. The cost of electric power by the latter methods is calculated to 0.5 to 1 SEK per kWh. The basic documentation of this report is presented in 4 separate reports which are partly evaluated in the appendices of this report.

4803 **(IVA—259) Rational use of electricity and electric power generation.** (Ingenjoersvetenskapsakademien, Stockholm (Sweden)). 1984. 172p. (In Swedish). (CONF-8310319—). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750228.

From IVA symposium on rational use of electricity and electric power generation; Stockholm, Sweden (28 Oct 1983).

In order to evaluate how the Swedish industry can use the electricity more efficiently and how the electricity in the future will be generated, a symposium was arranged by the Royal Swedish Academy of Engineering Sciences in Stockholm during October, 1983. It is of a great importance for the Swedish industry to plan for a more efficient way of using the electricity with regard to the higher costs in new electricity generating facilities. There are many new manufacturing processes being developed which together with different conservation steps, considerably will decrease the specific electricity usage for many products. Several ways exist to guide the industry to use the electricity more efficiently.

4804 **(IVA—261) Storage of electrical energy.** (Ingenjoersvetenskapsakademien, Stockholm (Sweden)). 1984. 155p. (In Swedish). (CONF-831273—). NTIS (US Sales Only), PC A08/MF A01. File Number DE85750227.

From Royal Swedish Academy of Engineering Sciences energy storage conference; Stockholm, Sweden (12 Dec 1983).

The report debates Sweden's need for power storage and presents some interesting techniques. The report contains the lectures held at a symposium on December 12, 1983, arranged by the Royal Swedish Academy of Engineering Sciences (IVA). Thanks to hydroelectric power accounting for a good half of Sweden's electricity production, the Swedish system for power production differs from the majority of those applied abroad. So, for the time being, there is not much need for power storage in the Swedish power system. The gradual reduction of nuclear power as well as the increasingly vulnerable and computerized society are, however factors which may add to the requirements for electrical energy. In addition to the need for storage in the Swedish electrical system and in the transportation sector, the report outlines some techniques for storage: pumped storage, flywheels, compressed air, and batteries.

4805 **(PB—84-226026) Long-range forecast and plan report for the Maryland Electric Utilities, 1983-1993. Annual report.** (Exeter Associates, Bethesda, MD (USA)). Feb 1984. 95p. NTIS, PC A05/MF A01.

See also PB83-150896. Sponsored in part by Maryland Dept. of State Planning, Baltimore.

As a result of declining load growth and reduced load growth projections over the past few years, Maryland's electric utilities have scaled back their construction programs. Accompanying the scaling back of power plant construction has been the recent emergence of 'demand-side' programs. The State's utilities have introduced and the Public Service Commission has approved 'buy-back' rates which enable non-utility power producers to sell their power to the utility. This arrangement is intended to encourage the development of alternative energy sources, including industrial cogeneration, small-scale hydroelectricity, municipal solid waste and photovoltaics.

4806 **The future of electric power in America.** Herod, J.S. (U.S. Department of Energy, Washington, DC). pp 24-25 of Shaping our energy future. Knoxville, TN, USA; LTM Consultants (1984). (CONF-840229—).

From 11. annual WATTec conference and exposition - shaping our energy future; Knoxville, TN, USA (21 Feb 1984).

Abstract only.

The Department of Energy relaesed a comprehensive, year long study of the electric power industry in June, 1983. Titled The Future of Electric Power in America: Economic Supply for Economic Growth, this study focused on the issues of demand growth, adequacy of economic types of generation supply, and the incentives for the industry to provide economic supply. The study found that demand is likely to grow at about the same rate as GNP. At a median GNP growth estimate, the study projected 3% electricity demand growth. The modeling that led to this conclusion found that substantial amounts of price induced conservation of electricity will occur in the next two decades, but that there will be countervailing increases in electricity use because the price of electricity will continue to become lower, relative to the aggregate price of other fuels. For example, in the 1973-1981 period, nationwide electricity prices increased 60% in real terms, but natural gas increased 200% and oil 300% in real terms. Primarily because of these price trends, electricity was the chosen heating fuel of 18.4% of U.S. households in 1980, vs 7.7% of households in 1970.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 2980004828

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 2990004288, 4427, 4452

4807 **(CONF-840568—) Pacific Northwest bioenergy systems: policies and applications. Proceedings.** (Lawrence and Craig, Inc., Portland, OR (USA)). 1984. Contract AP79-84BP13977. 313p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85001416.

From Pacific Northwest bioenergy systems policies and applications seminar; Portland, OR, USA (10 May 1984).

Selected papers presented at the seminar are included in this proceedings. Information is presented on the collection and use of wood and solid wastes for energy. Presentations discuss the economics of using wood fuels, recent developments in conversion technologies, policy considerations of using wood fuels from publicly owned lands, and possible environmental concerns. Separate abstracts have been prepared for each paper for inclusion in the Energy Data Base. (DMC)

4808 **(DOE/ER—0150/2) Advanced Energy Projects, FY 1984 research summaries.** (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Oct 1984. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003093.

This Division supports exploratory research on novel concepts related to energy. The research is usually aimed at establishing the scientific feasibility of a concept and, where appropriate, also at estimating its economic viability. Because projects supported inevitably involve a high degree of risk, an indication of a high potential payoff is required. This document includes brief summaries of these projects.

4809 **(DOE/ER/10623—T2) Identify and assess biomass: research and development. Technical status report.** (Viking Energy Corp., Pittsburgh, PA (USA)). 15 Dec 1980. Contract AC01-80ER10623. 16p. NTIS, PC A02. File Number DE85001576.

This study addresses the energy potential of biomass waste products from agricultural or farm operations and from industrial operations. Consideration is made of agricultural commodities with on-farm and off-farm applications taken separately. Conversion of the biomass wastes to alcohol fuels for use on and off farms is one possibility, especially for mobile energy requirements. Stationary energy requirements may be met by solid, gaseous, or liquid fuels. Stationary heating is the simplest category of energy use to be met by biomass fuels. Presently, petroleum consumption in agriculture amounts to over 2% of the total national energy consumption. The energy mix is proportionally much higher in petroleum products - 66% of farm energy. Energy potential for biomass and biomass-derived fuels is discussed, including methane from manures. 8 references, 2 figures, 8 tables.

4810 **(PB—84-225101) Current alternative energy research and development in Illinois, June 1984.** Swager, R. (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Jun 1984. 207p. NTIS, PC A10/MF A01.

See also PB84-154293.

This Directory is intended to acquaint researchers, policy makers and citizens with recent activities in alternative energy research, development and demonstration projects. The topics covered have been limited to those concerned with the development of non-fossil, non-nuclear energy sources. Included are projects in process in May, 1984 or that had been completed after November 1983. It attempts to include projects performed by Illinois organizations, both within the state and out-of-state, and projects performed by out-of-state organizations at sites within Illinois.

4811 **(SERI/TP—231-2483) Technology and production lead times: how much, how fast.** Neenan, B. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 20p. (CONF-8409175—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000506.

From Washington conference on fuel ethanol; Washington, DC, USA (13 Sep 1984).

A large number of forces, many political in nature, are currently affecting fuel markets, offering promising opportunities for some economic investors and causing anguish and erosion of capital for others. DOE and SERI research is designed to help bring order to the market through the development of alternative fuel production and utilization systems. As these systems reach the stage of commercial feasibility, many uncertainties regarding investments in future production or utilization capacity will be resolved, and markets can be expected to direct production and investment while providing least-cost transportation services to consumers. Through a commitment to work within the principles of competitive markets

in conducting research activities, SERI seeks to promote a long-lasting era of stable, renewable fuels that benefits all sectors of the economy and ensures the highest return on government investments in research and development. This report examines the implications of technology, demand, and investment on the alcohol fuel industry structure. 16 references, 16 figures, 1 table.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

REFER ALSO TO CITATION(S) 3001004457

4812 **(CONF-8410191—1) Review of the technology of fouling in MHD steam plants.** Johnson, T.R.; Chow, L.S.H.; Smyk, E.B. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003025.

From NSF/JSPS workshop; Bozeman, MT, USA (15 Oct 1984).

Although the steam generator for a coal-fired MHD system will be more difficult to design than a conventional coal-fired power plant or a Kraft paper recovery boiler, information obtained to date has indicated design criteria that will solve the slagging and fouling problems. Seed-slag fouling in MHD steam and air heaters appears to be a manageable problem if the convective tube banks are properly designed. However, a great deal of research and development work is still needed to obtain a reliable data base sufficient for the design of MHD steam plants. A solid base of technical information is needed in areas such as heat transfer, seed-slag chemistry, mass transfer, deposition rates, and deposit characteristics. A particularly important area is the sootblower performance over extended operating times, especially at gas temperatures above the seed melting point. To enable the designers to make trade-offs and to optimize the MHD system, these data must be obtained over a wide range of probable operating conditions; if possible, reliable, flexible computer models should be provided.

4813 **(CONF-8410191—2) Current MHD activities at Argonne National Laboratory.** Johnson, T.R.; Petrick, M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002749.

From NSF/JSPS workshop; Bozeman, MT, USA (15 Oct 1984).

Argonne's activities in the heat recovery-seed recovery area are directed toward several critical design issues that have been identified by assessments of MHD technology. These issues are corrosion and erosion of materials, NO behavior, fouling, and boiler design. The approach is to use computer modeling to study the problem area and to conduct experiments which will yield data over a range of conditions, so that the computer models can be validated and improved. These models can then be used in the design of large-scale systems.

4814 **Investigative Data Analysis of Faraday MHD generator experiments.** Unkel, W.; Swallom, D.W.; Mcclaine, A.W. (Avco Everett Research Lab., Inc., Everett, MA). *Journal of Energy;* 7: 523-528(Nov 1983). Contract AC22-80ET15614.

Data from experiments using a Mark VI Faraday MHD Generator Facility were analyzed, using a direct technique termed the Investigative Data Analysis. The axial variations of core properties are inferred from the data, with minimum sensitivity to the assumed boundary-layer and local electrical model, and to the values of wall leakage and conductivity level. The data were also used to deduce the degree of overshoot in the sidewall boundary layer and to infer the shape of the electrode wall boundary layer. The technique directly displays the sensitivity of the results to the model assumptions from which the accuracy of the results can be assessed. The technique has been implemented for near on-line display of the parameters during the actual run with the generator. The data are processed directly by the data acquisition computer, and the results are plotted and displayed with little user intervention. 14 references.

4815 **Acoustic and entropy waves in a nonideal combustion MHD generator.** Simons, T.D.; Eustis, R.H.; Mitchner, M. (Stanford Univ., CA). *Journal of Energy;* 7: 616-624(Nov 1983). Contract AC22-80ET15611.

Experimental measurements and a linearized theory using integral transforms examine the growth and attenuation of acoustic and entropy waves in MHD generators of weak interaction. A generalized quasi-one-dimensional model for the electrical parameters which includes implicitly some two- and three-dimensional nonideal effects such as boundary layers, heat-transfer, and near electrode phenomena has been included. The wave growth rates are obtained by perturbing the normal acoustic wave solutions with the effects of magnetic interaction. The model predicts that these nonideal phenomena have a mitigating effect on the level of magnetic interaction and may reduce wave growth rates significantly when the boundary-layer resistance is larger than the plasma core resistance. The experimental results suggest the presence of secondary flows which affect the near-electrode boundary layers and would exist in MHD generators of any scale. 32 references.

4816 **Oxidant system improvements for MHD energy conversion and industrial processes.** Juhasz, A.J. (NASA, Lewis Research Center, Cleveland, OH). *Journal of Energy;* 7: 716-723(Nov 1983). Contract AI01-77ET10769.

Previously cited in issue 05, p. 686, Accession no. A83-16735. 13 references.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 3005004423

4817 **(AD-A—142286/4) Methanol/water fuel container for 1.5 kW fuel cell power unit. Final report November 1981-December 1983.** Draeger, B.; McClelland, G. (Logical Technical Services Corp., Trenton, NJ (USA)). Feb 1984. 42p. NTIS, PC A03/MF A01.

A blow molded container of high density polyethylene has been developed to store methanol/water fuel (58% methanol) before and during use as a supply for a 1.5 kW fuel cell power unit for use in forward field positions by the US Army. Also included is accessory hardware needed to transfer the fuel. A limited number of containers and hardware have been delivered to the US Army Belvoir Research and Development Center. This work demonstrated the technical feasibility of producing the container in volume.

4818 (DOE/METC—84-10, pp 69-77) **Phosphoric acid fuel cell systems modeling.** Bloomfield, D.P. (Physical Sciences, Inc., Andover, MA). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

Of the several types of fuel cells, the phosphoric acid electrolyte fuel cell is in the highest stage of development. The incorporation of this technology into a power plant presents a number of challenges. The objective of this paper is to present the fundamental requirements of a phosphoric acid fuel cell simulation model appropriate for the systems modeler interested in power plant simulation, as opposed to the theoretical or experimental electrochemist. We discuss steady state modeling only. From the systems modeling standpoint, the most important characteristic of a fuel cell is its performance, or voltage current characteristic. After a brief review of the basic electrochemistry, we move to a discussion of those systems parameters which exert the major effects on individual electrode performance: operating conditions such as temperature, pressure, and reactant stream composition. It is also affected by design conditions such as catalyst loading, cell area, and reactant utilization. In the case of anodes, the effects are modeled as either Nernst or absorption phenomena. In the case of cathodes, the effects are modeled as Nernst, electrokinetic, and mass transport phenomena. We briefly cover scale-up losses such as resistance and flow distribution effects. Having covered cell fundamentals, we discuss steady-state model development, component and performance models such as anodes, cathodes and cell coolers. The function of these models is related to species and energy balance. The compo-

nent models also provide information used by the performance model. In the performance model we cover the aspects of empirical and theoretical modeling, in the level of detail appropriate for systems modeling.

4819 **Metal oxide solubility in eutectic Li/K carbonate melts.** Baumgartner, C.E. (General Electric Company, Corporate Research and Development, Schenectady, New York). *Journal of the American Ceramic Society;* 67: No. 7, 460-462(Jul 1984).

The equilibrium solubility of NiO, CuO, ZnO, $LiFeO_2$, and $LaNiO_3$ in binary Li/K carbonate was quantitatively measured between 823 and 1223 K under a simulated molten carbonate fuel cell cathode environment. The solubility of all materials, except $LaNiO_3$, was found to increase with increasing temperature. Equilibrium solubilities at 923 K, the operating temperature of a molten carbonate fuel cell, were determined to be 13 X 10^{-6}, 32 X 10^{-6}, 63 X 10^{-6}, and 16 X 10^{-6} mole fraction for NiO, CuO, ZnO, and $LiFeO_2$, respectively. The $LaNiO_3$ solubility remained below the quantitative detection limit until the melt's temperature exceeded 1123 K, at which time material decomposition was detected.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 3201004440, 4515, 4516, 4545, 4546, 4549, 4554

4820 **(BFR-G—4-1984) Ground heat - extraction and storage. Final report from the ground heat group of BFR. Basis for the planning of the activities of BFR 1984-1987.** (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1984. 97p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750223.

The state of the art concerning heat storage in earth, rocks and water is evaluated. Ground source heat pumps are being introduced on the market. Their potential is estimated to 20-30 TWh. Various systems of heat storage are under development, several pilot plants have been built and their potential for the coming 20 years can be 10-15 TWh. This survey will form the basis for the planning, of research and development administrated by the Swedish Council for Building Research (BFR) for the years 1984-1987. A list of current research and published reports is presented.

4821 **(BFR-R—108-1983) Air-to-water heat pump, mini oil boiler and accumulator. Study of a bivalent system for space heating in small houses.** Malm, A.T.; Yard, S. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 46p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750235.

A space and water heating system for small houses with heat pump, heat storage and a small oil burner for top load periods is discussed. The heat storage is performed in a water tank also housing the heat pump condensor. The temperature stratification in the tank will produce a low layer with temperature below the condensing temperature of the heat pump, and a high layer with temperature above this point, heated by the exhaust gases of the heat pump. The economy of this system is discussed, comparisons are made to oilburning systems, water carried electric heating and combined systems.

4822 **(BFR-R—131-1982) Saving energy in workmens cabins.** Joensson, B. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1982. 189p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. File Number DE85750211.

A report on a field investigation of saving energy in workmans cabins. The study was performed during the winter 1980/81.

4823 **(BFR-T—5-1984) Heat pumps for small houses. Scandinavian survey.** Poppius, H. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1984. 188p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. File Number DE85750224.

This publication presents a survey of the use of small heat pumps in Scandinavia. The technical basis of the design of heat pump systems is given. A list of state subsidized research and development projects is included together with laws and rules. A method of selecting the appropriate type and cost is described. The existing market and a list of suppliers are presented together with proper authorities. 68 literature references.

4824 **(BMFT-FB-T—84-130) Minimisation of energy-consumption for the new building of the International Meeting Center Berlin. Results of the optimisation of energy and the development of house technical installations.** Nikolic, V.; Rouvel, L.; Borbely, G. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1984. 162p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE84752273.

The architectural planning of the new IBZ (Internationales Begegnungszentrum) Berlin was supplemented by an optimisation of the overall concept under the aspect of energy conservation. For the following fields an optimisation has been carried out with respect to energy balance and performance: Thermal buffer zones; wintergardens; use of glazed attics as solar air heaters; performance of diesel engine driven heat pumps; determination of the solar fraction for space heating and water heating; development of appropriate space HVAC systems. Method: Calculation of the heat demand of the building using simulation methods, cost-benefit analysis, development of constructive measures. Results: Planing documents. Conclusion: Proposals for improved energetic characteristics of the planned building; development of building components for increased solar energy utilization; attic as a solar air heater; development of an appropriate heating system.

4825 **(DOE/BP—328) Pacific Northwest Residential Energy Consumption Survey: sample selection activities.** (Harris (Louis) and Associates, Inc., New York (USA)). 3 Aug 1983. Contract AC79-83BP39950. 93p. NTIS, PC A05. File Number DE85000485.

The primary purpose of the 1983 Pacific Northwest Residential Energy Consumption Survey is to obtain a comprehensive data base regarding household energy usage patterns incorporating not only general behavioral indicators of usage (e.g., temperature at which the dwelling is maintained at different times of day during the months of the year in which heating systems are activated or conservation measures effected) but also those characteristics lying further beyond the realm of immediate influence of the household dwellers which directly effect energy consumption (e.g., housing and household characteristics including square footage, number of floors or levels, the number and characteristics of the appliances in the household and household demographics/composition). The data base to be assembled as part of this research effort is also to include households' actual level of energy use for two major fuels (i.e., electricity and natural gas) obtained, with the consent of respondents, from their servicing utility(ies). Two samples have been incorporated in the study. The primary sample - the Regional Sample - will generate a large and comprehensive data base from a representative cross-section of individual households in the Pacific Northwest. A second, Supplementary Sample was incorporated in the survey design to ensure that a sufficient number of households not participating in qualified loan or grant programs, but comparable to participant households on a number of key descriptive characteristics, were included in the assessment. Inclusion of such households in the assessment will permit a formal evaluation of the loan/grant programs to be accomplished. Sampling procedures are described thoroughly.

4826 **(DOE/CS/30528—T1) Energy efficient commercial greenhouse utilizing moveable insulation (foam plastic beads) and solar storage. Final report.** Roston, W.; Greider, D. (Solar Central, Mechanicsburg, OH (USA)). 1984. Contract FC02-80CS30528. 45p. NTIS, PC A03. File Number DE84011781.

This project is based on several years of private research and development work aimed at producing a commercial size greenhouse which can be operated with reduced energy costs by combining conservation methods with active solar storage. The energy

conservation effort begins with a foam insulation below ground barrier around the entire outside wall to prevent heat loss through the earth. Additional foam insulation extends from the ground up to the rail which holds the bottom of the double layer of clear plastic which covers most of the structure, this insulation being removable to admit air for summer cooling. The house is a pipe structure made of bows four feet apart with the ends in concrete to provide resistance to pull-out due to high wind loads. The shape of the greenhouse is somewhat different from that of a standard house in that it must be much taller to provide steep walls from which the movable insulation will fall down to the exit pipes.

4827 **(DOE/CS/40074—T1) Development and test of a high COP Rankine heat pump for generation of process steam. Final report, Phase 2: fabrication and test.** Smoak, J.A.; Koebbeman, W.F. (Mechanical Technology, Inc., Latham, NY (USA)). Oct 1984. Contract AC07-77CS40074. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002600.

The steps taken to assemble and test the Rankine-driven heat pump are described. The following were performed: component bench tests, skid assembly, skid tests, system assembly, preliminary (cold) tests, alarms and safeties checkout, and hot tests. The test configurations are presented. Results are discussed for performance, endurance, and special tests. The systems cost analysis is included. (MHR)

4828 **(DOE/PE/70097—T2) Commercial and residential fuel oil consumption trends: 1970-1980. Volumes I and II.** Sulvetta, A.J.; Brown, K.; Niemczewski, C. (Centaur Associates, Inc., Washington, DC (USA)). Mar 1982. Contract AC01-79PE70097. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002166.

Fuel oil consumption data descriptions and matrices organized by source are provided. Data sources outside government which relied on government sponsored data bases are not cited. Instead, basic source documents, usually the government publication, is referenced to avoid duplication and avoid misleading inferences that alternative sources of information are available. The available data are synthesized to develop consumption trends for heating fuel by major sector. Data limitations, thwarted complete fulfillment of all objectives of the study (i.e., disaggregating heating fuel consumption trends between the residential and commercial sectors for No. 2, No. 4 and kerosene distillates for years 1970 through 1980). Data bases on factors which may have affected heating oil consumption are summarized. Sources are identified and described for (1) fuel oil prices in the residential, commercial, and industrial sectors; (2) residential heating characteristics for new residential units and conversions to alternative fuels; (3) conservation and thermal efficiency improvements in the residential stock; and (4) weather (heating degree days). Analyses of the factors affecting fuel oil consumption based on the data sources described are presented. Findings of the study, along with limitations, are discussed.

4829 **(EGG—2343) Magnetic heat pump feasibility assessment.** Kirol, L.D.; Mills, J.I.; Fullmer, K.S.; Zabriskie, J.N. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1984. Contract AC07-76ID01570. 279p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85002806.

A study has been conducted to determine the feasibility of using magnetic heat pumps in high temperature (to 500 K) industrial applications. The heat pumps were very attractive from a technical viewpoint, but not yet economically feasible. There is good potential for achieving cost reductions necessary to realize economic feasibility. Superconducting magnets, cryogenic cooling for the superconducting magnets, and working materials are the major cost items. Computer simulations were used to quantify magnetic heat pump performance, and theoretical working material properties were used. Further work will include laboratory determination of material properties and verification of heat pump performance.

4830 **(LBL—18247) Analysis of window performance in a single-family residence.** Selkowitz, S.; Sullivan, R. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 8p. (CONF-840954—8). NTIS, PC A02. File Number DE85000619.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

Results of a parametric study of the energy performance of a prototypical single-family ranch-style house are presented. The DOE-2.1B computer program was used to analyze the variation in heating, cooling, and total energy requirements due to changes in the following fenestration characteristics: orientation, size, conductance, and shading coefficient. These parameters allow us to estimate the performance of hypothetical fenestration systems using advanced aperture materials as well as commercially available products. The work represents the initial phase of a study in which the influence of other residential parameters such as internal loads, infiltration levels, natural ventilation, use of night insulation, shade management, and overhangs will also be investigated. Climate sensitivity was established by considering results from Madison, Wisconsin, and Lake Charles, Louisiana. To simplify the analysis, multiple regression techniques were used to generate a simplified algebraic expression that relates energy use to the parameters varied. This representation could form the technical basis for simplified design tools for selecting optimal fenestration parameters.

4831 **(N—84-26132) Predicting energy savings attributed to daylighting.** Robbins, C.L. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1983. 4p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 47-50, N—84-26125 16-44.

A method for estimating a building's energy savings attributable to daylighting by predicting the percentage of the year that the electric lighting system is not in use is described. This method depends upon the particular control stragegy chosen, a standard work year, and the amount of light (as a daylight factor, DF) reaching any given station in the building.

4832 **(N—84-26133) Predicted impact of linear roof apertures on the energy performance of office buildings.** Place, W.; Coutier, P.; Fontoynont, M.; Kammerud, R.C.; Andersson, B.; Bauman, F.; Carroll, W.L.; Howard, T.C.; Mertol, A.; Webster, T.L. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nov 1983. 11p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 52-62, N—84-26125 16-44.

The potential lighting electricity reductions and associated thermal impacts of replacing electric light with sunlight admitted through rooftop glazing on a single-story, prototypical office building were investigated. Experimental scale models were used to determine the fraction of the solar radiation entering the aperture which reaches the work plane as useful illumination. From this building energy analysis computer program was generated. Results of computer simulation indicate that a large fraction of the electricity consumed for lighting a single-story office building can be displaced using modest amounts of glazing in the roof. Smaller heating and cooling energy consumption reductions are possible from a daylighting system. The design implications of the results are discussed and future directions for the work are outlined.

4833 **(N—84-26145) Whole building performance monitoring: measurements on baseline buildings.** Stoops, J.; Kurkowski, T. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. 5p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 136-139, N—84-26125 16-44.

Large amounts of energy consumed in buildings can be cost effectively conserved, and the state of the art data acquisition systems identifies and characterizes such opportunities at low cost, for which metered data were completed. The acquisition of a data base to fulfill the needs of various users is discussed. The project entails an inventory of existing data sources, and an assessment of the adequacy of available data to study the energy use interactions of typical commercial buildings. Compilation of an accurate and easily accessible source of hourly end use consumption data and determinants is undertaken. Low cost data acquisition techniques were developed.

4834 **(N—84-26146) Performance monitoring highlights of BERD programs.** Boulin, J.J.; Ross, H.D. (Department of Energy, Washington, DC (USA)). Nov 1983. 5p. NTIS, PC A13/MF A01.

In MCC Assoc., Inc., proceedings of the passive and hybrid solar energy update, 141-145, N—84-26125 16-44.

Building performance monitoring is the measuring, through the use of instrumentation, the characteristics of a whole building or some components or set of components of a building. Component and whole building performance are addressed. In the component area these programs address performance monitoring in the areas of: (1) infiltration and ventilation (2) thermal mass in walls and (3) windows and daylighting. Some examaples of whole building monitoring concern: model validation and performance characterization. Activities with examples are reviewed.

4835 **(NMERDI—2-71-4224) Test and evaluation of evaporative water chilling. Final report.** Redman, C.M. (New Mexico Solar Energy Inst., Las Cruces (USA)). Oct 1984. 163p. NTIS, PC A08/MF A01 - NMERDI, Univ. of New Mexico, 457 Washington SE, Albuquerque, NM 87108. File Number DE85900194.

This project demonstrated and tested a technique of water chilling using a single heat exchanger to lower the wet-bulb temperature of ambient air prior to the evaporative chilling of water. This evaporative water chilling technique used precooled air dried by means of heat flow from the input dry side of a heat exchanger into the output wet side, with water added to maintain close to 100% relative humidity. Three systems utilizing two reverse flow and one cross flow air-to-air heat exchangers were constructed and tested. Based on the data acquired, systems can be constructed with coefficients of performance (COP) exceeding 20 and chilled water temperatures within 5°F of ambient air wet bulb. Design recommendations are that higher efficiency pumps and fans (test system pumps were about 7% and fans were 7 and 20% efficient) be used, that the fans be placed at the exhaust end rather than the air input side to decrease turbulence, and that the cross section of the evaporative media be increased. Based on the proposed design changes, it is projected that evaporative water chilling in southern New Mexico can furnish below 65°F water 91% of the year, below 55°F water 71% of the year, and below 44°F water 41% of the year with nominal COPs of 20. The systems, except for some component parts, can be fabricated in New Mexico.

4836 **(ORNL/Sub—80-7948/2) Southwest Thermal Mass Study. Observation and prediction of the heating season thermal mass effect for eight test buildings with and without Windows. Research Phase II, January 1983-June 1983.** Robertson, D.K. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.). Sep 1984. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85003190.

Eight one-room test buildings, 6.1 m square and 2.3 m high inside, were constructed on a high desert site near Tesuque Pueblo, New Mexico, to study the influence of wall dynamic heat transfer characteristics on building heating energy requirements (such influence is sometimes called the thermal mass effect). The buildings are nominally identical except for the walls, and are instrumented to record building component temperatures and heat fluxes; indoor temperature, humidity, globe temperature, and interior surface temperatures; and outdoor weather, solar data, and ground temperatures. This report presents the results from analysis of heating season data for one-and-a-half heating seasons. For the first heating season, the buildings were windowless; for the last half, windows were added to most of the buildings, and insulation was added to one massive building. The simplified analysis methodology developed in an earlier technical report, consisting of comparisons of each building's energy use with that of a massive, windowless reference building, was utilized. It was found, as before, that deviations from proportionality to the massive building (energy use in excess of steady-state predictions using average weather data) result from increased average interior temperature during those days when heating is required for part of the day. Specifically, it was found that the following increased the percentage effect: lack of envelope thermal mass, increased solar gain to the interior, and increased wall R-value. The maximum observed effect was 5.3% +- 2% excess energy use in the most lightweight building. A method was developed to evaluate the effect for any set of weather conditions (with insolation levels similar to New Mexico).

4837 **(PB—84-204437) Operating efficiency of central heating boilers for individual houses. Operation of boilers at constant output temperature. Effects of oversizing.** (Centre Scientifique et Technique de la Construction, Brussels (Belgium)). 1983. 37p. (In French). NTIS, PC E04/MF E04.

Summaries in French, Dutch, English and German.

The theoretical review includes: notation used, principal formulae used; load factor f of a boiler: equations enabling one to calculate f, the load factor, commentary and simplifying assumptions, simplified equation for the winter season, simplified equation for very short, extremely cold, without sunshine periods; evolution of the factor for stop losses q. Effect of oversizing on boilers: extreme values of the seasonal load factor f, good practice for quick estimation of boiler capacity; and worked examples: choice of boiler capacity for a new building (determination of the boiler's nominal power rating, determination of boiler performance), replacement of boilers (study of different cases), thermal improvement of the building envelope (with and without replacement of the boiler).

4838 **(PB—84-205194) Specially promoted programme, energy in buildings. Abbreviated grant reports, December 1983.** Smith, W.A.; Wiltshire, T.J. (Rutherford Appleton Lab., Chilton (UK)). 1984. 65p. (RAL—84-010). NTIS, PC E04/MF E04.

The specially promoted program on energy in buildings has now awarded 45 research grants (up to the end of 1982). The Building Sub Committee asked the SPP coordinators to obtain each year brief reports on grants in progress or completed. This is a collected version of these reports obtained between November and December 1983.

4839 **(PB—84-210582) Comparative evaluation of insulating sealed glass units.** (Ontario Ministry of Municipal Affairs and Housing, Toronto (Canada)). Jan 1984. 79p. NTIS, PC E05/MF E01.

Sponsored in part by Ontario Ministry of Energy, Toronto. Prepared in cooperation with Ontario Research Foundation, Toronto.

Tests were conducted in the Building Performance Centre at Ontario Research in conjunction with the Ontario Ministry of Municipal Affairs and Housing - Research and Development section, to evaluate insulating sealed glass units on a comparative basis. As a result of this program, it was possible to compare thermal performance, sound attenuation, and seal durability of double and triple glazed sealed units using a polysulphide and/or polyisobutylene edge seal. The objective of this program was to provide performance and supporting technical data which could be used by consumers to make informed choices among the many types of sealed units presently on the market in Canada.

4840 **(PNL-SA—12135) Development of a data base on end-use energy consumption in commercial buildings.** Heidell, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1984. Contract AC06-76RL01830. 15p. (CONF-840819—14). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003104.

From Doing better: setting an agenda for the second decade; Santa Cruz, CA, USA (14 Aug 1984).

A comprehensive inventory of end-use metered data in commercial buildings constructed was completed using typical design practices. This paper summarizes the results of the inventory and the examination of the types of data measurements desired by building researchers. The inventory and the definition of data needs are used to develop an assessment of end-use data on existing commercial buildings and to determine the need for a public domain data base. This inventory represents the most thorough review of end-use data collected to date. It is based upon over 250 contacts with state energy offices, trade and professional organizations, private architectural and engineering firms, utilities, and federal agencies. In addition, a comprehensive literature search was conducted. The results are summarized by the types of end-uses collected, the data collection method, the time resolution of the data, the availability

of the data, related supporting data, and sources of existing documentation. Supporting data reviewed include: building construction details, building operation characteristics, occupancy characteristics, occupancy information, and microclimate data.

4841 **(SERI/TP—253-2461) Digital and color energy maps for graphic display of hourly data.** Christensen, C. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 10p. (CONF-840954—10). NTIS, PC A02/MF A01. File Number DE85000526.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

The display of hourly data is discussed. Existing methods based on contour plots, design-day graphs, and three-dimensional surfaces are reviewed, the relationships noted; and the possibilities for extending and combining existing methods described. Problems with using typical weather days are discussed, and new methods based on sequential days are described, including energy maps. Examples of color energy maps are given for three versions of a four-zone commercial building, and patterns of energy use are noted and interpreted. The display of hourly data is discussed primarily in terms of simulation results, but the approach is equally applicable to measured data from monitored buildings or any source of hourly data.

4842 **(SERI/TP—253-2485) Approaches to analyzing the thermal performance of commercial buildings.** Burch, J.D. (Solar Energy Research Inst., Golden, CO (USA)). Sep 1984. Contract AC02-83CH10093. 13p. (CONF-8409118—6). NTIS, PC A02; 3; GPO Dep. File Number DE84013044.

From Passive and hybrid solar energy update; Washington, DC, USA (5 Sep 1984).

Building thermal performance monitoring involves acquiring appropriate data, adjusting a thermal model to that data, and using the adjusted thermal model to answer questions regarding actual or potential building thermal operation. A monitoring method is thus classified by data type, model used, and calculation procedures. Data types are based upon the aggregation level of inherent spatial and temporal variations. The two most useful thermal models are long-term energy balance and macrodynamic simulation. Calculations involve a choice of reference building to be assumed for savings or retrofit analyses and procedures for normalizing building size, occupancy, and weather. Using this framework, several examples are analyzed.

4843 **(SERI/TP—255-2454) Laser sealed evacuated window glazings.** Benson, D.K.; Tracy, C.E.; Jorgensen, G.J. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1984. Contract AC02-83CH10093. 7p. (CONF-840872—31). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000512.

From SPIE annual technical symposium; San Diego, CA, USA (19 Aug 1984).

The design and fabrication of a highly insulating, evacuated window glazing have been investigated. A thermal network model has been used to parametrically predict the thermal performance of such a window. Achievable design, options are predicted to provide a glazing with a thermal conductance less than 0.6 W/m^2K (R > 10°F ft^2 h/Btu) which is compact, lightweight, and durable. A CO_2 laser has been used to produce a continuous, leak tight, welded glass perimeter seal around 25 x 25 cm^2 test specimens. Various diameters of regularly spaced spherical support spacers were incorporated in the specimens as well as an integral SnO_2:F transparent, low emissivity coating for suppression of radiative heat transfer. Laser sealing rates of .06 cm/s were achieved at a 580°C glass working temperature with 400 W of continuous wave (CW) laser power.

4844 **(WTHD—162) The absorption heat pump with lithium bromide/zinc bromide/methanol.** Iedema, P.D. (Technische Hogeschool Delft (Netherlands). Afdeling der Werktuigbouwkunde). Apr 1984. 335p. ECN, P.O. Box 1, 1755 ZG Petten, Netherlands.

Sorption systems in general allow the transformation of heat flows to other temperature levels. The gas-fired absorption heat pump (AHP) for individual domestic heating is especially dealt with, in which a heat flow at high temperature, provided by burning natural gas, joins a heat flow at low level from ambient in order to produce a heat flow at moderate level, that meets the heat demand (10 kW). However, the present findings permit a wider application, for instance to sorption systems on small or industrial scale for cooling by solar or waste heat or transformation of waste heat to higher temperature levels. Three main subjects, treated in both theoretical and experimental ways, are dealt with: analysis of complete AHP systems; thermophysical properties of LiBr and/or ZnBr/sub 2//CH/sub 3/OH; transport phenomena in the absorber. (J.C.R.)

3202 Transportation

REFER ALSO TO CITATION(S) 3202004860

4845 **(DOE/CS/54262—T2) Energy Efficient Vehicle Competition. Progress report.** (SCORE, Inc., Cambridge, MA (USA)). 1979. Contract FG01-78CS54262. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002889.

This report summarizes the progress to date of the Energy Efficient Vehicles Competition sponsored by the Student Competitions on Relevant Engineering, Inc. On October 2, 1979, the University of Florida was chosen from several applicants to be the host school of the EEVC Coordinating Committee. This committee is comprised of six student members and one faculty advisor. Duties include establishing the rules and guidelines, organizing major meetings, choosing judges and advisors and speakers, and planning the Final Test Event. During the first year, major fundraising campaigns were undertaken. It was also during this time that the first push for entries was initiated. Over fifty schools returned positive responses to our invitations.

4846 **(DOT-I—84-14) Short-range public transportation improvements. Final report.** Kirby, R.F.; Miller, G.K. (Urban Inst., Washington, DC (USA)). Feb 1983. 126p. GPO. File Number TI85900387.

Over the past decade, the Urban Mass Transportation Administration (UMTA) of the US Department of Transportation has funded research and demonstration projects to test a variety of short-range improvements, and has monitored a number of innovative schemes implemented by state and local governments. This volume reviews and synthesizes the results of that research and development effort. To aid planners and decision-makers with a particular set of transportation objectives, potential innovations have been grouped according to the primary travel market served: home-to-work, special user group, or general purpose. Major planning issues are discussed for each of these markets, along with the types of innovations that have potential for achieving certain objectives. This volume also discusses potential changes in the administrative and regulatory environment for public transportation. New developments in the institutional framework for decision-making and planning are addressed, along with recent experience with labor protection requirements, local taxi fare and service regulations, and the management of automobile use.

4847 **(PB—84-211333) Road-load coastdown testing of selected 1981 thru 1984 model year light-duty vehicles and light-duty trucks. Technical report.** (Environmental Protection Agency, Ann Arbor, MI (USA). Certification Div.). Apr 1984. 16p. NTIS, PC A02/MF A01.

Twenty-four 1981 through 1984 model year light-duty vehicles and light-duty trucks were tested to determine the force required to overcome the sum of aero-dynamic drag, tire rolling resistance and other frictional losses. The primary purpose of this testing was to compare the results from production vehicles with information submitted by the manufacturers for the Environmental Protection Agency's (EPA) emission certification and fuel economy programs. Reevaluation of EPA's entire alternate road-load procedure was a secondary goal.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 3203004203, 4204, 4206, 4207, 4844, 4857, 5383

4848 (DOE/ER/10645—12) Process design and control strategies for enhanced energy efficiency and productivity in the process industries. Progress report, June 1, 1983-July 31, 1984. Morari, M.; Ray, W.H.; Rudd, D.F. (Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering). Aug 1984. Contract AC02-80ER10645. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002533.

During the fourteen months covered by this progress report the work on all three energy management subprojects proceeded essentially on schedule and no noteworthy deviations from the outline conceived at the start of the project were found necessary. The results are summarized by subproject: design of resilient processing systems, operation of complex processing system, and computer aided design software.

4849 (DOE/ID/12429—T1) Research into an asymmetric membrane hollow fiber device for oxygen enriched air production. Phase 1 final report. Gollan, A.Z.; Kleper, M.H. (A/G Technology Corp., Needham, MA (USA)). Sep 1984. Contract AC07-83ID12429. 145p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85003193.

Oxygen enriched air combustion is a major potential energy conservation measure for American industry. Enrichment of oxygen content in air to the range of 30% to 35% during combustion benefits energy conservation in two ways. First, it leads to higher flame temperatures which in turn result in higher heat transfer rates with a concommittant reduction in process time requirements. Second, the parasitic nitrogen volume to be heated and subsequently vented at elevated temperatures is lowered. In this program a semi-permeable polymeric membrane system which overcomes the limitations of prior membrane technology has been developed for oxygen enrichment. This integral, asymmetric membrane displays both higher separation factors for oxygen to nitrogen than silicone rubber membranes while exhibiting product flowrates which result in an air separation system more economically attractive to industry. Furthermore, these membranes have been produced in the highly compact hollow fiber form which will result in the most cost-effective membrane module configuration.

4850 (N—84-25167) ECUT: Energy Conversion and Utilization Technologies program. Industry, university and research interest in the US Department of Energy ECUT biocatalysis research activity. Wilcox, R.E. (Jet Propulsion Lab., Pasadena, CA (USA)). Nov 1983. 39p. (NASA-CR—173553; JPL-PUB—83-90). NTIS, PC A03/MF A01.

The results of a Research Opportunity Notice (RON) disseminated by the Jet Propulsion Laboratory for the U.S. Department of Energy Conversion and Utilization Technologies (ECUT) Program's Biocatalysis Research Activity are presented. The RON was issued in late April of 1983 and solicited expressions of interest from petrochemical and chemical companies, bioengineering firms, biochemical engineering consultants, private research laboratories, and universities for participating in a federal research program to investigate potential applications of biotechnology in producing chemicals. The RON results indicate that broad interest exists within the nation's industry, universities, and research institutes for the Activity and its planned research and development program.

4851 (NP—5770013) Energy consumption in coal mining and the processing industries 1970 through 1982, by administrative districts. (Hessisches Statistisches Landesamt, Wiesbaden (Germany, F.R.)). 1983. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770013.

Tables are presented on coal, fuel oil, electricity and gas consumption 1970 through 1982 in the mining industry, primary industry, producer goods industry, investment goods industry, consumption goods industry, and the food, beverages and tobacco industry.

4852 (SLU-LBT—35) Computer control of the greenhouse climate - an introduction. Andreasson, I.; Stroem, K. (Sveriges Lantbruksuniversitet, Lund. Inst. foer Lantbrukets Byggnadsteknik). 1983. 107p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750229.

A typical greenhouse has, compared to other kinds of buildings, a rather low thermal mass, rather bad insulation and it acts as a solar collector during a hot day. The dynamical behaviour of the greenhouse, when it is heated, is influenced by that kind of heating system which is in use, i.e. hot air heating compared to water pipe heating. In the water pipe system a lot of heat is stored in the pipes. The ventilation rate is strongly dependent on the wind speed and the direction of the wind. This causes problems with regard to the control of the ventilation windows. The introduction of computers for controlling the greenhouse environment raises possibilities of a totally new development in this field. In the computer several functions, earlier separated, can be integrated, i.e. heating, ventilation, water, CO_2-enrichment, shading, light a.s.o. More complicated control algorithms can be used as the software is easy to modify. The capability of the computer to process information makes it possible, at least to some degree, to optimize the crop yield depending on how much resources that are consumed, i.e. energy. Intense research all over the world opens new areas, due to new sensor constructions. An interesting field is the hydropond growing of plants.

4853 (SLU-LBT—1983-32) Short-term storage of energy in salt-hydrate melts for greenhouses. Magnusson, G. (Sveriges Lantbruksuniversitet, Lund. Inst. foer Lantbrukets Byggnadsteknik). Apr 1983. 39p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750219.

In utilizing solar energy for greenhouse heating, the need for heat storage is obvious. One way of performing a short-term storage is to use salt-hydrate that goes through a phase-change in a suitable temperature range, a PCM storage. This study focuses on some aspects of short-term storage of energy for greenhouse heating, using salt as the storage medium. A calculation model has been used to compute technical parameters for a PCM storage connected to a greenhouse covered with double acrylic sheet. The energy saving, by using a short-term storage and excess heat, is about 20 percent of the total energy need during one year. The costs for the storage is estimated to 6-20 oere/kWh stored energy, depending on different assumptions in the investment calculation.

4854 (SLU-LBT—1983-33) Ventilating and heating systems in greenhouses. Basic data for fan systems. Stroem, K. (Sveriges Lantbruksuniversitet, Lund. Inst. foer Lantbrukets Byggnadsteknik). Apr 1983. 44p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750220.

The task of the greenhouse ventilating system is among other to depress the air temperature in the greenhouse, when surplus energy from the solar radiation exists. The ventilation could be carried out by different methods, i.e. natural ventilation or with fan assistance. If fans are used, an integration of heating and ventilating is possible for greenhouse systems. Greater importance should be focused on the air circulation and the moist transportation effect of the ventilating system. Both effects become more and more important in the new insulated and more airtight greenhouses with smaller temperature gradients. The lowest capacity of the ventilating system occurs when the vent openings are closed and the fans are shut off. This ventilation is called the unvoluntary ventilation. This ventilation for three greenhouses was measured by the tracer gas method, in Alnarp. The method is described and the results are given. As an interesting value for the unvoluntary ventilation at a wind speed of 2 m/s, in one of the single glazed greenhouses in Alnarp, the value of 0.18 air exchanges per hour is presented.

4855 (SLU-LBT—1983-34) Infrared heating in the greenhouse. Andreasson, I. (Sveriges Lantbruksuniversitet, Lund. Inst. foer Lantbrukets Byggnadsteknik). Jun 1983. 71p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750221.

The use of infrared heating for greenhouses has recently been discussed in Sweden due to positive results in investigations in USA and Canada. Infrared radiation can be created by using gas or electricity. The latter is today most common in residential green-

houses. One of the advantages in using infrared heating systems is that the air temperature in the greenhouse can be decreased and in that way the energy consumption could also decrease without decreasing the temperature of the crop. The infrared heating system can be used when humidity is high and/or when the inner surfaces in the house are cold and cause radiation losses from the crop. Energy can be saved by lower air temperatures and also by the possibilities to compensate rapid changes in the outside weather conditions by the fast infrared heating system. This compensation requires, however, that the radiation level can be controlled in an adequate way. Another possible advantage is the biological effects on disease, which easily arise due to condensation on the leaf surfaces (e.g. botrytis). In Sweden electrical infrared heating is the most interesting alternative, but gas can become interesting in the future. Electrical infrared heating can be used together with other heat sources, for instance a heating system distributing heat with water as fluid, at the floor level or in the tables. The economy of the investment depends on how much money the possible positive biological effect means to the grower. The amount of energy, saved, is dependent on the design of the heating system, the properties of the building, how the system is controlled and on how long periods the infrared system is active.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 3206004418, 4797, 4798

4856 (BFR-R—47-1983) Energy from district water supplies. Grafstroem, H.; Hyden, H.; Kihlblom, U. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1983. 77p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750216.

Considerable amounts of heat to be used for district heating can locally be recovered from drinking water supplies using ground water with artificial infiltration. A study of 18 plants with yearly production of some 150 Mm^3 shows a recoverable heat resource of 0.5 TWh/year. The total potential for Sweden is estimated to 1 TWh/year. For example, the municipalities of Nykoeping and Soedertaelje are well suited for erecting heat pump plants using drinking water as a heat source with capacities of 1-8 MW and heat production costs of 0.10-0.14 SEK/kWh (about 1.3-1.8 cents/kWh) at a 4 per cent real interest rate. A demonstration plant at any of these sites would be of interest for studying possible effects on the water distribution network from the lower water temperatures.

4857 (BMFT-FB-T—84-062) Absorption heat pump system for capacities in the MW-range and discharge temperatures higher than 100°C. Malewski, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Apr 1984. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750260.

The purpose of the project was to plan an industrial size absorption heat pumps system based on the experiences gained from ammonia-water absorption refrigeration techniques, to build a demonstration plant for a heat out-put of 3,5 MW, to prove calculated heat coefficients by measurements during test operation and to obtain operational experience. After preparing of all necessary design documentation an open-air plant with a capacity of 3,5 MW out-put was built using a heat source with temperatures of 20...50°C and transferring the heat to a district heating system which works at delivery temperature of about 90°C. During test-runs, about 15 000 MWh were delivered into the district heating system operating the plant within a range of 0.75 MW minimum and 4,2 MW maximum out-put capacity. The following temperature ranges were covered by measurements: heat source from 10 to 50°C, down-stream from 40°C to 60°C, up-stream from 70°C to 105°C. The predicted heat coefficients were reached. Based on the described working range absorption heat pump systems are suited for more than 2 MW out-put capacities, base-load plants with high annual operation period, especially for central heating systems and district heating networks.

4858 (CONF-841096—2) Utility conservation programs: a first step toward involvement in community energy management. Kier, P.H.; Bernard, M.J. III. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002550.

From Colloquium on community energy management as an economic development strategy; Lincoln, NE, USA (14 Oct 1984).

Recently established demand-side energy conservation programs have required a reexamination of the basis of utility regulation and of the function of utilities. In contrast to their traditional role as monopolistic product-providers, energy utilities are being asked to provide services in a nonmonopolistic setting. Some representative conservation programs are discussed and ranked according to degree of utility involvement with community energy management. In general, utilities have become only minimally involved; several reasons for this are discussed.

4859 (DOE/BP—261) Saving power: 1984 conservation sourcebook. (USDOE Bonneville Power Administration, Portland, OR. Office of Conservation). Jun 1984. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001852.

The Conservation Sourcebook provides an overview of Bonneville Power Administration's (BPA) conservation efforts in 1983 and the framework for future actions. BPA's conservation program accomplishments to date are described, including those for which implementation contracts were recently offered, and explains program support activities. It outlines the program planning process and the programs selected for design as a result of that process. BPA's conservation-related research and development projects are explained, including the agency's pilot program efforts. Finally, a section on policy and analysis describes the many issues BPA is addressing in its current program development work.

4860 (PB—84-213990) Performance evaluation of waterproofing membrane protective systems for concrete bridge decks. Final report 3 January-3 November 1983. Babaei, K.; Terrel, R.L. (Washington State Transportation Center, Seattle (USA)). Aug 1983. 254p. NTIS, PC A12/MF A01.

This study develops a methodology for field appraisal and evaluates the effectiveness of three selected waterproofing membrane installations presently in service in the State of Washington. Based on the information obtained, none of the test installations had completely sealed the passage of salt into the concrete decks. 'Active' and 'uncertain' corrosion potentials existed at the rehabilitated portions; however, a decrease in corrosion activity since the time of rehabilitation was noted. Concrete deterioration after rehabilitation has occurred mainly within the boundaries of the repair work and original concrete, and it is more evident in areas with a shallower rebar depth. It is recommended that future research include a greater number of bridge decks. In addition, service life performance data should be obtained through long-range monitoring of the installations.

4861 (PB—84-217090) Containment of dioxin emissions from refuse fired thermal processing units: prospects and technical issues. Shaub, W.M. (National Bureau of Standards, Washington, DC (USA). Center for Fire Research). Apr 1984. 151p. (NBSIR—84-2872). NTIS, PC A08/MF A01.

This report reviews and addresses the prospects for and technical issues concerned with the utilization of chemisorption as a technique for containment of dioxin emissions from refuse fired thermal processing units. The results developed in this report suggest that containment, through chemisorption of dioxin emissions from refuse fired thermal processing units, may be technically feasible. Suggestions for research objectives and full scale tests are outlined. Refuse fired thermal processing units equipped for energy recovery may be more preferable than those units which are not equipped for energy recovery, if chemisorption occurs more efficiently at temperatures which are substantially lower than furnace gas exit temperatures.

3209 Education And Public Relations

4862 (PB—84-204338) Building conservation: UK sources of information. Ward, S.F. (Sheffield Univ. (UK). Dept. of Information Studies). Mar 1983. 117p. NTIS, PC E06/MF E06.

Errata sheet inserted.

This survey is intended to identify the producers and users of the literature of building conservation, and to ascertain whether the needs of the latter group are fulfilled by the former. It also examines the work of the main organizations in this area, and the provision of library and information services to meet the needs of all involved in any aspect of building conservation work.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 3300004845

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 3301004438, 4502, 4871, 4875, 4878

4863 (DGMK—285) Sludge formation in diesel engines. (Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)). May 1983. 90p. (In German). Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.).

Oil thickening and sludge deposits in diesel engines may lead to serious problems in service. Investigation work has been done in order to develop a test procedure which should be able to discriminate between engine oils with different dispersancy level referring to oil thickening and sludge deposits in correlation to known field performance. In conclusion the test results showed: Under suitable test conditions using the test procedure CEC L-17-A-78 the engine oils showed clearly different characteristics concerning oil thickening versus insolubles content, depending on dispersancy level of the oil. These results from engine bench tests are absolutely in line with corresponding field performance observed, including the fact that sludge deposits could only be observed with low dispersancy engine oils.

4864 (DOE/CE/50036—T8) Engine wear and cold startability of methanol fueled engines. Browning, L.H.; Pullman, J.B.; Pefley, R.K. (Santa Clara Univ., CA (USA)). 1984. Contract FG03-84CE50036. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001208.

While alcohol fuels have moved towards commercialization, two problems have not been satisfactorily resolved. These are cold-start, warm-up driveability and corrosion and wear of fuel system and engine parts. In addition, environmental factor assessments must continuously be made if the public is to be assured that the alcohols are more benign than petroleum in terms of environmental, health, and safety factors.

4865 (EUR—8358) No-coolant diesel engine. Timoney, S.G. (Commission of the European Communities, Luxembourg). 1983. 88p. (EUR—8358-EN). NTIS, PC 05/MF E05.

The design of an opposed-piston, single-crankshaft, rocker-arm, two-stroke engine with automatic compression ratio variation and disposal of unused heat through the exhaust only is proposed as a means for improving the energy-conversion efficiency of road vehicles. The idea of a no-coolant design was adopted, because 25-30% of the energy from the fuel is lost in the traditional cooling system of a diesel engine. Non-traditional materials such as ceramics were tested for use in the engine and silicon carbide was found to be the preferred material.

4866 (EUR—9074-EN/IT) Gas-oil/water emulsion fuel for automotive diesel engines. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 178p. (In Italian). Concepcion Univ. (Chile). Departamento de Fisiopatologia.

In this paper the work performed within the contract EE-C-201-I is reported. The results achieved in the tests of high speed diesel engines with water in oil emulsion feeding system are summarized. First, carried out trials on test bench are described; then operation in light duty truck on the road and on roller test bench is reported and trials with constant speed diesel engine are related. Finally, the work about emulsion characterization is synthetized. The conclusion shows as the water in oil emulsion is a feeding system suitable for high speed diesel engine operation because BSFC, grade of smoke, exhaust temperature and emission are lowered without considerable troubles.

4867 (N—84-25017) Holographic aids for internal combustion engine flow studies. Regan, C. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1984. 12p. (NASA-TM—83681; E—2070; CONF-8406118—6). NTIS, PC A02/MF A01.

From 7. international conference of women engineers and scientists; Washington, DC, USA (17 Jun 1984).

Worldwide interest in improving the fuel efficiency of internal combustion (I.C.) engines has sparked research efforts designed to learn more about the flow processes of these engines. The flow fields must be understood prior to fuel injection in order to design efficient valves, piston geometries, and fuel injectors. Knowledge of the flow field is also necessary to determine the heat transfer to combustion chamber surfaces. Computational codes can predict velocity and turbulence patterns, but experimental verification is mandatory to justify their basic assumptions. Due to their nonintrusive nature, optical methods are ideally suited to provide the necessary velocity verification data. Optical sytems such as Schlieren photography, laser velocimetry, and illuminated particle visualization are used in I.C. engines, and now their versatility is improved by employing holography. These holographically enhanced optical techniques are described with emphasis on their applications in I.C. engines.

4868 (N—84-28095) Dissociation charts for use in spark ignition engine performance work (S.I. units). Lucas, G.G. (Loughborough Univ. of Technology (UK)). 1984. 27p. (TT—8403). NTIS, PC A03/MF A01.

Dissociation charts were prepared to enable the pressure-volume diagram of the Otto cycle to be determined simply, allowing for the effects of dissociation and that the working fluid is air mixed with fuel and/or combustion products. The charts were calculated for the fuel iso-octane and for equivalence ratios 0.8, 0.9, 1.0, 1.1, 1.2. For each equivalence ratio, two charts are presented: before combustion and after combustion. (ESA)

4869 (N—84-28245) Brayton module development overview. Holbeck, H.J. (Jet Propulsion Lab., Pasadena, CA (USA)). Mar 1984. 3p. NTIS, PC A15/MF A01.

The Advanced Gas Turbine (AGT) and the Subatmospheric Brayton Cycle (SABC) engines are under development. The AGT is developed for automotive applications while the SABC is developed for a gas fired heat pump application. Trade studies of the AGT, the SABC and other existing gas turbins are conducted in combination with various concentrators. The recommendation from these studies is to use the SABC for near term module development while following the AGT development for later advanced application. A preliminary design is completed at the module.

4870 (NP—5770016) Acceleration behaviour of utility vehicle diesel engines with turbocharging. Rosenkranz, H.G. (Stuttgart Univ. (Germany, F.R.). Fakultaet 5 - Energietechnik). 21 Dec 1982. 240p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85770016.

As a vehicle drive, internal combustion engines with turbocharging show a worse acceleration capacity than aspirating engines of the same nominal capacity. A test stand was developed especially for studies on acceleration together with the measurement

technology required. In addition, the development and adaptation of a simple motor engine model is described. By means of the result of the test stand experiments of the computer simulation, it is shown that the present development of utility vehicle diesel engines with turbocharging are of approximately the same order either stationary or non-stationary under otherwise identical conditions, if in both cases the same fuel quantity is injected at partial-load acceleration and if the air ratio does not fall below a certain value. If, however, the diesel engine works at too low an air ratio in order to reduce soot emission through load-pressure-dependent limitation of injection quantity, the acceleration problems mentioned will occur. In the experiment or the computer simulation, a possible method showed how to possibly reduce the negative effects of this load-pressure-dependent reduction of injection quantity and the form of motor moment by more rapid load-pressure build-up and how to possibly enhance acceleration capacity by improved control of the injection pumps.

3302 External Combustion Engines

REFER ALSO TO CITATION(S) 3302004485, 4489, 4490, 4491, 4492, 4493, 4494, 4495, 4496, 4501, 4565

4871 **(N—84-28231) Overview of advanced Stirling and gas turbine engine development programs and implications for solar thermal electrical applications.** Alger, D. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1984. 1p. NTIS, PC A15/MF A01.

The DOE automotive advanced engine development projects managed by the NASA Lewis Research Center were described. These included one Stirling cycle engine development and two air Brayton cycle development. Other engine research activities included: (1) an air Brayton engine development sponsored by the Gas Research Institute, and (2) plans for development of a Stirling cycle engine for space use. Current and potential use of these various engines with solar parabolic dishes were discussed.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 3303004769, 4874

4872 **(DOE/NV/10029—1) City of Austin, Texas, Electric Vehicle Demonstration Project. Final report.** Brecher, A. (Austin, City of, TX (USA). Urban Transportation Dept.). 1984. Contract FC08-79NV10029. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003124.

On January 10, 1980, the City Council awarded a bid to Jet Industries of Austin, Texas, for fifteen electric vehicles, i.e., nine vans, four sedans, two pickups. In August, 1980, seven vehicles were placed in operation; five vehicles in September; one in October; and two in January, 1981. The vehicles were assigned to eight different city departments and have been operated and maintained for a four year period. Data, which consisted of information on daily operations, maintenance, and battery replacements, were collected on each vehicle throughout the project period. The Vehicle and Equipment Services (VES) Department analyzed the data and concluded that electric vehicles can be used for some city services; however, the cost per mile to operate and the incidence of downtime was considerably higher compared to similar gasoline or diesel-powered vehicles. The high cost to operate the electric vehicles is attributed to several factors; the low usage of the vehicles, the high degree of maintenance, frequent battery replacements, and poor performance. Use of the fleet was minimal, averaging only 6654 miles per unit for the entire project period. The highest mileage recorded on any one vehicle was 13,509 miles and the lowest mileage recorded was 1337 miles.

4873 **(DOE/NV/10030—1) City of Fort Collins Electric Vehicle Demonstration Program. Final report.** (Fort Collins, City of, CO (USA)). Sep 1984. Contract FC08-79NV10030. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002371.

The operating experience for the use of electric vehicles for city business is presented. Maintenance costs, equipment failures, and the manufacturers going out of business are described and discussed. (MHR)

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 3304004875

4874 **(DOE/NV/10110—1) Electric/Hybrid Vehicle (E/HV) Demonstration/Test Project. Final report.** Wright, F.D. (San Jose, City of, CA (USA)). 9 Oct 1984. Contract FC08-80NV10110. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002370.

The project, within the City of San Jose, involved eight agencies with ten electric vehicles. These vehicles were used for administrative transport, parts pickup and delivery, and for maintenance/service support tasks. The final evaluation of the project would have to be classified as mixed. The hoped for general consensus of support for electric vehicles did not evolve. The personnel who drove these vehicles complained of poor ride and lack of range. The purpose of the project, nevertheless, was fulfilled; in that, it demonstrated the requirements for any future plans for electric vehicle use. First, there must be greater vendor support for maintaining the vehicles. Second, parts must be more readily available. Third, the vendors must be more stable - all of ours went out of business before the second year of operation was completed. This was largely due to the reduction in the fourth requirement of support for the project from the federal government.

3305 Flywheel Propulsion

4875 **Can fiber composite flywheels increase automobile fuel economy?.** O'Connell, L.G. (Lawrence Livermore National Lab., Livermore, CA 94550). pp 935-946 of Materials and process continuing innovations. Vol. 28. Azusa, CA, USA; SAMPE (1983). (CONF-830408—).

From 28. national Society for the Advancement of Materials Process Engineers symposium; Anaheim, CA, USA (12 Apr 1983).

This paper results from a recent review of analytical studies of flywheel/heat engine propulsion systems for automobiles that have been conducted over the last 10 or so years and the current expectations of the Fiber Composite Flywheel Development Project within the Transportation Systems Research Program at LLNL. This has provided a more global understanding of the prospects for fiber composite flywheels to increase fuel economy. It has also surfaced issues that need to be addressed both experimentally and analytically if fiber composite flywheels are to find a niche in the automotive market. These findings are presented.

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 3306004847

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 3308004322, 4438, 4866

4876 **(N—84-27341) Lead file: car fuel additives.** Joumard, R.; Chiron, M.; Delsey, J.; Lambert, J. (Institut de Recherche de Transports, Broa (France). Centre d'Evaluation et de Recherches des Nuisances et de l'Energie). Nov 1983. 76p. NTIS, PC A05/MF A01.

Rate of consumption of and health hazards due to lead additives in gasoline are described. Changes in hemoglobin synthesis and the negative effects on the psychological and intellectual development of children are illustrated. Lead is a poison to catalysts that could be used to control other pollutants. The energy and financial costs of alternatives to lead are analyzed, concluding that a lead-free 91 octane gasoline could be the answer, if engine technology developments are adopted. (ESA)

4877 (NE-BF—83-8) Environmental risks on handling alternative automotive fuels. Bertilsson, B.M. (Naemnden foer Energiproduktionsforskning, Stockholm (Sweden)). 1983. 466p. (In Swedish). NTIS (US Sales Only), PC A20/MF A01. File Number DE85750234.

The aim of the investigation was to identify environmental and safety problems and to discuss the solution of problems in production, storage, tranport, distribution and selling. The production of methanol from coal, peat and biomass will bring about new waste problems. The conversion of ashes to vitrified slag is preferred. On the other hand the process of producing gas from peat and biomass is not fully established yet and the production of ethanol implies problems with the by-products of the fermentation process. There are no satisfactory data concerning the danger of explosion of methanol. The release of methanol into sea on wreckage does not seem to have serious consequences, whereas burning methanol and ethanol must be quashed by means of alcohol-resistant foams. The evaporation of methanol fuels contains aromatic hydrocarbons and benzene, and is dependent on the properties of the original gasoline. The use of denaturants and the adaption to the rules of the Common Market is discussed. The toxic effects of gasoline and gasohol were found to be more serious than the effects of ethanol and methanol. The details of the investigations are presented in 9 supplements.

4878 (NIPER—21-Vol.3) Utilization research. Volume III. Monthly progress report, October 1984. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 15 Nov 1984. Contract FC01-83FE60149. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002971.

Baseline tests of two methanol-fueled vehicles were completed in project OU1A. The vehicles will be used in a study of volatile components for cold start and emission control deterioration with mileage accumulation. Analysis of blending stocks indicate that target values for aromatic content and distillation temperature of finished fuels are achievable. The fuels will be produced by Phillips Petroleum Company for use in project OU1B. Methodology for collecting particulate samples representing a composite of several engine operating modes was developed for project OU2.

36 MATERIALS

REFER ALSO TO CITATION(S) 3600005623

4879 (DOE/ER/01198—T6) Panel report on new materials. (Stanford Univ., CA (USA). Center for Materials Research). Dec 1979. Contract AC02-76ER01198. 140p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85002843.

The panel was organized to generate a report on needs and opportunities in basic research on new materials, having a link with energy-related problems facing technology. Covered are: inorganic synthesis, new polymers, intermetallics, amorphous solids, thin films, solid state ionics, catalysis, and semiconductors. (DLC)

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 3601004182, 4643, 4644, 4645, 4645, 4646, 4647, 4647, 4648, 4648, 4674, 4674, 4674, 4697, 4721, 5011, 5065, 5121, 5160, 5160, 5162, 6091, 6092, 6093

4880 (AD-A—142280/7) Surface layer effects on the mechanical behavior of metals. Research and development report. Kramer, I.R. (David W. Taylor Research and Development Center, Bethesda, MD (USA)). May 1984. 217p. (DTNSRDC—84/027). NTIS, PC A10/MF A01.

The effect of the surface layer on the mechanical behavior of metals is discussed. There is a considerable body of experimental evidence to show that, even in uni-axially deformed specimens, the work hardening is not uniform throughout the cross-section. Rather, the work hardening characteristics of a surface layer that extends approximately 100 micrometers differs considerably from the work hardening characteristics of the interior. The surface layer is shown to have a very large influence on the stress-strain behavior as well as the creep, fatigue and stress-corrosion resistance. The effect of the surface layer on the activation energy and activation volume is discussed. The experimental evidence on polycrystalline metals indicates that in high and low temperature creep, fatigue, stress corrosion and tensile deformation, the dislocation sources near free surfaces operate at lower stresses and more profusely than those in the interior. As measured by X-ray diffraction line profile analysis, the dislocation density in the surface layer, rho sub s, and in the interior, rho sub i increases during fatigue cycling and stress-corrosion exposure. The influence of environment on the mechanical behavior appears to be associated with surface layer.

4881 (AD-A—953185/6) Hydrogen in steel. Ash, E.J. (Watertown Arsenal, MA (USA)). 13 Apr 1936. 9p. NTIS, PC A02/MF A01.

4882 (AD-A—953188/0) Protective coatings for selective carburization. Vanick, J.S.; Herschman, H.K. (Watertown Arsenal Labs., MA (USA)). 16 Aug 1923. 40p. (WAL—633/4). NTIS, PC A03/MF A01.

4883 (AD-A—953189/8) Comparative efficiency of carburizers by carbon and nitrogen penetration measurements. (Watertown Arsenal, MA (USA)). 1923. 13p. NTIS, PC A02/MF A01.

4884 (AD-A—953196/3) High temperature homogenizing investigation. (Watertown Arsenal, MA (USA)). 9 Feb 1937. 31p. NTIS MF A01.

4885 (AD-A—953208/6) Development of a standard operating procedure for a six and one-half ton basic-electric steel furnace using optimum conditions of desulphurization and dephosphorization. Zotos, J. (Rodman Lab., Watertown, MA (USA)). Oct 1956. 47p. NTIS, PC A03/MF A01.

4886 (AD-A—953263/1) Letter from carborundum company regarding carbofrax tubes. (Watertown Arsenal, MA (USA)). 8 Feb 1939. 43p. NTIS, PC A03/MF A01.

4887 (AD-A—953265/6) Study of the physico-chemical transformations in a liquid mass of metal cast solid and subjected to centrifugal force during solidification centrifugal casting. Quincy, M.L. (Watertown Arsenal, MA (USA)). Sep 1934. 47p. NTIS, PC A03/MF A01.

4888 (AERE-R—11291) Upper shelf toughness of six submerged-arc weldmetals manufactured using Linde 124 flux. Druce, S.G.; Hippsley, C.A. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics and Metallurgy Div.). Jun 1984. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780197.

This paper describes the testing technique, data analysis procedures and results from the first phase of an experimental programme investigating upper shelf toughness of six submerged-arc weldmetals. The welds were manufactured using uncoated, Nickel coated and Copper coated wire electrodes and Linde 124 flux. J integral crack growth resistance curves have been derived from tests on single specimens over a range in temperature from 150 to 290 deg C. The results indicate a general decline in toughness with increasing temperature. At 290 deg C, the levels of initiation toughness from all six welds were essentially constant varying between 152 to 159 MPa square root of m. The Jsub(I)-R curves derived from this work are compared with toughness data used in the Marshall Study Group report of an assessment of the integrity of PWR pressure vessels.

4889 (CONF-841184—6) Fermi surface study of CeSb. Aoki, H.; Crabtree, G.W.; Joss, W.; Hulliger, F. (Argonne National Lab., IL (USA); Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik). Sep 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002532.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

A Fermi surface study of the ferromagnetic phase of CeSb is presented. The γ frequency branches arising from the electron surfaces at the X points, three separate frequency branches from the hole surfaces at the Γ point and the low frequency branch α have been observed. The effective mass ratios are low and range from $\sim$ 0.2 for the α branch to $\sim$ 1.0 for the high frequency branch of γ. The low effective mass ratios suggest that the admixture of the conduction states with the f state is small. We have observed a drastic change in the appearance of the dHvA signal at the phase transition between the ferromagnetic and lower field antiferromagnetic phases: The low frequency α oscillation suddenly disappears as the crystal enters the antiferromagnetic phase. By utilizing the change in the signal appearance, the transition field strength has been measured as a function of the field direction. The present experimental results, particularly the origin of the α oscillation, are discussed in the light of the p-f mixing theory and recent band structure calculations based on localized f orbitals.

4890 **(CONF-841184—7) Magnetization of very thin Ni films in epitaxial metal film sandwiches of Cu.** Sill, L.R.; Brodsky, M.B.; Bowen, S.; Hamaker, H.C. (Argonne National Lab., IL (USA); Northern Illinois Univ., Dekalb (USA)). Sep 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001840.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

Single crystal nickel films varying in thickness from 2-40 A were prepared by epitaxial growth between thicker layers (500 A) of single-crystal copper (001). Their magnetization was measured as a function of field up to 10 kOe using a DC SQUID magnetometer. The saturation magnetization of these films was determined as a function of Ni thickness at liquid helium temperatures. A decrease in saturation moment from that of bulk nickel was observed for films of thickness less than 18 A. The apparent Curie temperature also decreases with decreasing thickness for these films. The magnetization at maximum field as a function of temperature does not follow a Brillouin function.

4891 **(CONF-841184—9) Observation of standing spin-waves in thin Fe-films by means of Raman spectroscopy.** Blumenroeder, S.; Zirngiebl, E.; Gruenberg, P.; Guentherodt, G. II. (Koeln Univ. (Germany, F.R.). 1. Physikalisches Inst.; Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Sep 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003036.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

We report on the first observation of standing spinwaves in thin evaporated Fe-films by means of Raman scattering (RS). In earlier investigations using Brillouin scattering (BS) these modes could only be observed down to a thickness d$\approx$ 200 A. We were now able to extend this range down to d $\approx$ 120 A using BS and to a range of 40 to 80 A using RS. We find that for values of d comparable to the penetration depth of the light the scattering intensity decreases together with d. This is explained by the assumption that the scattering intensity is determined by the net magnetic moment resulting within the probing depth of the light. The mode frequencies observed by Raman scattering follow very well a D/sub ex/* d^{-2} relationship from which the value of the exchange parameter D/sub ex/ has been determined. With decreasing d we also observe an increasing linewidth of the standing spinwaves. This can be attributed to the increased importance of surface roughness on the damping of these modes. 8 references, 4 figures.

4892 **(CONF-841184—10) Ferromagnetic resonance in a Ni-Mo superlattice.** Pechan, M.J.; Salamon, M.B.; Schuller, I.K. (Miami Univ., Oxford, OH (USA). Dept. of Physics; Illinois Univ., Urbana (USA). Dept. of Physics; Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003039.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

Ferromagnetic resonance (FMR) measurements, at room temperature and at 4.2°K, have been made on a layered Ni(249A)-Mo(83A) superlattice. We have examined the resonance position as a function of the angle between the film normal and the applied field. From these measurements we obtain q = 2.2 +- 0.05 and a magnetization of 220+20 Oe. While the g value agrees with that of bulk Ni, the magnetization is lower than that obtained for bulk Ni and also for this sample using both light scattering and direct measurement techniques. This low magnetization contrasts with FMR measurements on compositionally modulated Ni-Cu samples, where the magnetization was reported to be greater than that of bulk Ni. We show that a reduced value of the magnetization is consistent with perpendicular uniaxial anisotropy. Using M/sub sat/ = 360 Oe from bulk measurements or 300 Oe from the optical data we find H/sub A/ = 1.58 kOe or 0.83 kOe respectively. When the applied field is $<20°$ from the surface normal, additional lines appear that move to higher fields than the main resonance. The separations are an order of magnitude too small to be due to spin wave resonances with the spin wave stiffness of bulk Ni. The highest field resonance indicates a magnetization of 331 Oe. This suggests the existence of Ni regions which experience negligible anisotropy.

4893 **(CONF-841246—2) Sputter-induced compositional modifications in a Ni-Au alloy.** Lam, N.Q.; Hoff, H.A.; Regniert, P.G. (Argonne National Lab., IL (USA)). Sep 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002771.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

Surface and subsurface compositional changes induced by heating and by ion sputtering of a Ni-6 at. % Au alloy at temperatures between 25 and 600°c were measured in situ, using the ion-scattering-spectroscopy technique. Upon heating, Au atoms segregated to the alloy surface; the enthalpy and entropy of Gibbsian adsorption were found to be -0.45 eV and -1.09k. During sputtering, the steady-state surface composition was noticeably temperature-dependent above ~400°C, which could be interpreted in terms of significant contributions of the second atom layer to the sputtered-atom flux. Steady-state concentration profiles measured after rapid cooling of the target to room temperature were analyzed to gain information about the temperature dependence of the effective altered-layer thickness, from which the radiation-enhanced diffusion coefficients in the bombarded alloy were determined.

4894 **(CONF-841246—6) Microstructural changes in dilute Ni-Be alloys during HVEM sub-threshold irradiations.** Regnier, P.G.; Lam, N.Q. (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002775.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

The microstructural sensitivity of Ni-0.7 at.% Be alloys to HVEM sub-threshold irradiations was investigated. Several aspects were examined: (1) dose dependence of the microstructure change during irradiation with 350-keV electrons at 350°C; (2) energy dependence of the incubation dose for the first appearance of black dots in the alloy films under irradiation at 350°C along various crystallographic directions; and (3) temperature dependence of the microstructural evolution during 350-keV electron irradiation. It was found that sub-threshold irradiations were capable of inducing nonequilibrium solute segregation. Below approx. 400°C, segregation-induced homogeneous precipitation of the γ-phase occurred in the alloy matrix, whereas at higher temperatures, only heterogeneous precipitation was observed at defect sinks. From the information about the energy dependence of the incubation dose for precipitation, the displacement threshold energy for Ni and point-defect production rate by secondary Be-Ni collisions were estimated.

4895 **(CONF-8310337—1) Spinodal decomposition in Fe-32Cr.** Lasalle, J.C.; Spooner, S.; Schwartz, L.H. (Northwestern Univ., Evanston, IL (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002321.

From Conference on early stages of decomposition of alloys; Crete, Greece (17 Oct 1983).

Spinodal decomposition in iron-chromium alloys has been studied for various composition and aging temperatures by several

workers using small angle neutron scattering. The data of the present study and that of previous workers are reviewed in order to better define the coexistance curve of this system as well as to provide an experimental basis for comparison with current nonlinear theories of spinodal decomposition. Regarding the coexistence curve, it is argued that the qualitative changes in the scattering pattern with composition and aging temperature are consistent with the experimentally determined boundary, rather than those calculated for this system. Quantitative analysis of the kinetic development of scattering from Fe-32Cr samples allows direct comparison with predictions of nonlinear theories of spinodal decomposition. The time dependence of the position of the peak maximum has been given by several theories as t/sup -phi/. The value of phi found for Fe-32Cr increased with increasing aging temperature, extrapolating near the value of 1/6 at the estimated spinodal temperature.

4896 **(CONF-8310340—1) Interfacial segregation and fracture.** Yoo, M.H.; White, C.L.; Trinkaus, H. (Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000971.

From ASM materials science seminar on flow and fracture at elevated temperature; Philadelphia, PA, USA (1 Oct 1983).

A brief review is given of the physical mechanisms which control nucleation, growth, and coalescence of intergranular cavities during deformation of polycrystalline materials at intermediate temperatures under low applied stress. Effects of interfacial solute segregation on creep ductility are discussed by considering its effects on interfacial energies and diffusivities. The available experimental data concerning detrimental and beneficial solute effects on creep rupture life of model alloy systems are found to be consistent with the calculated time to rupture. Our limited understanding of the grain boundary chemistry effects on creep embrittlement of commercial structural alloys is pointed out, and further experimental and theoretical studies for the better understanding of controlling mechanisms are suggested.

4897 **(CONF-8409102—6) Mossbauer spectroscopy of actinide intermetallics.** Kalvius, G.M.; Potzel, W.; Moser, J.; Litterst, F.J.; Asch, L.; Zankert, J.; Potzel, U.; Kratzer, A.; Wunsch, M.; Gal, J. (Argonne National Lab., IL (USA); Technische Univ. Muenchen, Garching (Germany, F.R.). Fakultaet fuer Physik; Ben-Gurion Univ. of the Negev, Beersheba (Israel); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale; Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). Sep 1984. Contract W-31-109-ENG-38. 52p. NTIS, PC A04. File Number DE85002543.

From EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics; St. Polten, Austria (3 Sep 1984).

Due to their wider radial extend the 5f electrons may form bands of different width and hybridization in metallic compounds of the light actinides. This leads to a broad spectrum of magnetic properties ranging from the localized magnetism of the lanthanides to the itinerant electron magnetism often found in transition metal compounds. Also, the influence of the crystalline electric field tends to be more pronounced than in rare earth compounds, but is usually not as dominant as in the 3d series. Magnetic structures and the question of 5f electron delocalization are reviewed with respet to actinide Moessbauer data and new results are presented. In particular the influence of applying external pressure is discussed. 60 references, 24 figures.

4898 **(CONF-8410142—28) Irradiation effects in low-alloy reactor pressure vessel steels (Heavy-Section Steel Technology Program Series 4 and 5).** Berggren, R.G.; McGowan, J.J.; Menke, B.H.; Nanstad, R.K.; Thoms, K.R. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002592.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

Multiple testing is done at two laboratories of typical nuclear pressure vessel materials (both irradiated and unirradiated) and statistical analyses of the test results. Multiple tests are conducted at each of several test temperatures for each material, standard deviations are determined, and results from the two laboratories are compared. The Fourth Heavy-Section Steel Technology (HSST) Irradiation Series, almost completed, was aimed at elastic-plastic and fully plastic fracture toughness of low-copper weldments (current practice welds). A typical nuclear pressure vessel plate steel was included for statistical purposes. The Fifth HSST Irradiation Series, now in progress, is aimed at determining the shape of the K/sub IR/ curve after significant radiation-induced shift of the transition temperatures. This series includes irradiated test specimens of thicknesses up to 100 mm and weldment compositions typical of early nuclear power reactor pressure vessel welds.

4899 **(GKSS—84/E/26) Crack tip opening displacement for work hardening materials.** Schwalbe, K.H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 7p. (CONF-8404198—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750264.

From ASTM committee week meeting; Jacksonville, FL, USA (8 Apr 1984).

Starting with a Mode III- Mode I-Analog, the details of which were presented several years ago, a closed form solution for the crack tip opening displacement for work hardening materials is derived both for plane stress and plane strain. This results agree very well with Shih's finite element calculations. Comparison is also made with some experimental data.

4900 **(HEDL—7487) Swelling of neutron-irradiated 85Ni-15Cr at 400 to 650°C.** Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003005.

The binary alloy 85Ni-15Cr swells during neutron irradiation in a manner quite unrepresentative of either Fe-Ni-Cr ternary alloys or pure nickel. Chromium additions appear to depress void nucleation in nickel but also appear to suppress the tendency of nickel to saturate in swelling at high exposure. Below a transition temperature somewhere in the range $538°C < T < 593°C$ the swelling is quite insensitive to irradiation temperature. Above the transition temperature the swelling behavior is more complex. At these higher temperatures the alloy densifies at low fluences, which is also indicative of the possible occurrence of long or short-range order. The swelling transition temperature also appears to coincide with the critical temperature for order-disorder transformation.

4901 **(HEDL—7490) Ion bombardment survey of the swelling resistance of Fe-Cr-Mn alloys.** Garner, F.A.; Brager, H.R.; Lee, E.H.; Mansur, L.K. (Hanford Engineering Development Lab., Richland, WA (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC06-76FF02170. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003004.

A series of simple Fe-Cr-Mn alloys has been prepared and will be irradiated with iron ions in order to determine the influence of alloy composition on void swelling.

4902 **(HEDL—7491) Compositional micro-oscillations in ion-bombarded Fe-35Ni-7Cr.** Brager, H.R.; Garner, F.A.; Lauritzen, T. (Hanford Engineering Development Lab., Richland, WA (USA); General Electric Co., Sunnyvale, CA (USA)). Sep 1984. Contract AC06-76FF02170. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003006.

The compositional micro-oscillations observed in neutron-irradiated Fe-35.5Ni-7.5Cr at 593°C and 38 dpa have also been found in Fe-35.0Ni-7.0Cr irradiated with nickel ions to 117 dpa at 625°C. The period of the oscillations found in both specimens is on the order of 200 to 400 nm. During irradiation the matrix of this alloy subdivides toward near-stoichiometric zones of Fe_3Ni and FeNi, with chromium substituting for iron.

4903 **(HEDL—7494) Influence of cold-work on the neutron-induced swelling of Fe-Ni-Cr ternary alloys.** Garner, F.A.; Brager, H.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002995.

The swelling of simple Fe-Ni-Cr ternary alloys in EBR-II appears to be sensitive to both irradiation temperature and cold-work. It is suggested that cold-work interacts with the tendency of Fe-Ni-Cr alloys to order during irradiation and thereby affects swelling.

4904 **(HEDL—7501) Swelling of Fe-Cr-Mn ternary alloys in FFTF.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76FF02170. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003001.

The swelling of nine simple Fe-Mn binary and Fe-Cr-Mn ternary alloys has been measured by an immersion density technique after irradiation at ~ 520°C to 3.2 x 10^{22} n/cm², E > 0.1 MeV, or ~ 15 dpa. The swelling of these alloys decreases with manganese but exhibits a dependence on manganese content that is weaker than that of nickel in Fe-Cr-Ni alloys. The dependence on chromium is even weaker, in sharp contrast to the behavior observed in Fe-Cr-Ni alloys.

4905 **(HEDL—7502) Reirradiation of HFIR specimens in FFTF.** Brager, H.R.; Garner, F.A.; Maziasz, P.J. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003002.

A series of AISI 316 and PCA specimens previously irradiated in HFIR to doses ranging from 10 to 44 dpa have been measured to determine their density and then included in the MOTA irradiation experiment for continued irradiation in FFTF. These specimens were divided into two subsets to be discharged after 30 and 60 dpa.

4906 **(HEDL—7503) Conductivity changes in neutron-irradiated commercial copper alloys at ~ 450°C.** Brager, H.R.; Garner, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003007.

The electrical conductivity changes induced in nine copper-base alloys during irradiation at 450°C in FFTF have been measured. Alloys which contain beryllium as one of their constituents exhibit an increase in electrical conductivity, while those that do not contain beryllium exhibit a decrease in conductivity. The change in conductivity appears to correlate with the original conductivity of the alloy.

4907 **(HEDL-SA—3037-FP) In-reactor creep of selected ferritic alloys.** Puigh, R.J. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 23p. (CONF-840604—29). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003019.

From 12. international symposium on effects of radiation on materials; Williamsburg, VA, USA (18 Jun 1984).

In-reactor creep data to a peak fluence of 5.7 x 10^{22} n/cm² (E > 0.1 MeV) for irradiation temperatures between 380 and 570°C have been obtained for the ferritic alloys HT9, 9Cr-1Mo, and 2-1/4Cr-1Mo. Also, in-reactor creep data for HT9 has been obtained at 650°C at a fluence of 2.9 x 10^{22} n/cm² (E > 0.1 MeV). For irradiation temperatures less than 520°C, the creep strains for all ferritic alloys are small and less than predicted for 20% cold worked 316 SS. At 570°C, thermal creep mechanisms become important and 2-1/4Cr-1Mo loses its creep resistance. HT9 loses its creep resistance at 650°C and exhibits large diametral strains (> 24%).

4908 **(HEDL-SA—3152-FP) Influence of silicon on void nucleation in irradiated alloys.** Esmailzadeh, B.; Kumar, A.; Garner, F.A. (Missouri Univ., Rolla (USA); Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 10p. (CONF-841246—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003014.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

The addition of silicon to pure nickel, Ni-Cr alloys and Fe-Ni-Cr alloys raises the diffusivity of each of the alloy components. The resultant increase in the effective vacancy diffusion coefficient causes large reductions in the nucleation rate of voids during irradiation. This extends the transient regime of swelling, which is controlled not only by the amount of silicon in solution but also by the precipitation kinetics of precipitates rich in nickel and silicon.

4909 **(IS-M—520) Fast diffusion and electrotransport of iron in scandium.** Carlson, O.N.; Axtell, S.C.; Conzemius, R.J. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 21p. (CONF-8409179—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002677.

From American Institute of Mining, Metallurgical and Petroleum Engineers conference; Detroit, MI, USA (17 Sep 1984).

Iron is a fast diffusing element in both crystalline forms of scandium. This conclusion is based on its high diffusivities in α and β-Sc and its low activation energy for diffusion in α-Sc. The diffusivities in both phases and activation energy for diffusion in the low temperature phase are comparable to those for iron in other rare earth metals.

4910 **(IS-M—521) Effect of oxygen on mechanical properties of Nb-V alloy.** Carlson, O.N.; Indrawirawan, H. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 9p. (CONF-8409179—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002681.

From American Institute of Mining, Metallurgical and Petroleum Engineers conference; Detroit, MI, USA (17 Sep 1984).

The results of a study of the effect of oxygen on the mechanical properties of a Nb-10 at. % V alloy are described. The effect of oxygen on the tensile yield strength, ductility and strain rate sensitivity were determined as a function of temperature for the range of 78 to 300°K. The effect of vanadium on the oxygen Snoek peak in niobium was determined as a function of vanadium concentration. It was observed that the addition of up to 10 at. % vanadium shifts the oxygen peak temperature upward about 80°K. The activation energy for relaxation of oxygen increases from 108.8 KJ/mole for pure niobium to 154 KJ/mole for 2.5 at. % V and to 200 KJ/mole for 10 at. % V. A possible interpretation of these observations is presented in terms of a substitutional-interstitial solute interaction.

4911 **(IS-M—527) Ferromagnetic hysteresis and the effects of stress on magnetisation.** Jiles, D.C. (Queen's Univ., Kingston, Ontario (Canada). Dept. of Physics; Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 14p. (CONF-840738—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003080.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

In considering the effects of stress on magnetization of ferromagnets the order of application of stress and field is important. The effects of stress can not be simply explained on the basis of the magnetostriction coefficient and the sign of the stress. A model of ferromagnetic hysteresis has been presented. The effects of stress on magnetization can be explained on the basis of the model which also indicates why the order of application of stress and field is significant.

4912 **(ITPR—81013) Theory of superconducting alloys II.** Reithofer, R.; Schachinger, E.; Schossmann, M. (Technische Univ., Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik). Apr 1984. 131p. NTIS (US Sales Only), PC A07/MF A01. File Number DE84703346.

The first part of this report (Schachinger (1981)) dealt with a rather crude model for the electron-impurity interaction, namely

the first Born's approximation. This report reviews in its second chapter the basic theory by Rusinov to describe the strong electron-paramagnetic impurity interaction. The interaction terms are then used to describe the physical behaviour of weak as well as strong coupling isotropic superconducting alloys. In chapter three numerical results for strong coupling superconductors are presented and are compared with experiment and results of equivalent BCS-calculations. The main purpose of this paper is to establish that it is necessary - even for weak coupling systems - to use a full strong coupling analysis whenever a comparison theory-experiment is made. In chapter four the anisotropic superconducting alloy is investigated, first on the basis of the BCS-theory. It is shown, that anisotropy induces additional effects and these effects are clearely discussed by comparing equivalent anisotropic and isotropic systems. Finally, in the last part of this chapter the full strong coupling analysis on the basis of Fermi Surface Harmonics is presented.

4913 **(KAERI/RR—321/81) Liquid sodium technology research.** Kim, W.C.; Lee, Y.W.; Nam, H.Y.; Chun, S.Y.; Kim, J.; Won, S.Y. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 96p. (In Korean). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780091.

This report describes the technology of impurity control and measurement of liquid sodium, problems associated with material degradation and change of heat transfer characteristics in liquid sodium, and the conceptual design of multipurpose sodium test loop. Discussion and the subsequent analysis are also made with regard to the test results for the sodium-H_20 reaction and its effects on the system.

4914 (KEK—82-3, pp 32-41) **Irradiation of aluminium alloy materials with electron beam.** Konno, Osamu; Masumoto, Kazuyoshi (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

It is a theme with a room for discussion to employ the stainless steel composed of longer half-life materials for the vacuum system of accelerators, from the viewpoint of radiation exposure. Therefore, it is desirable to use aluminium of shorter half-life in place of stainless steel. As a result of investigation on the above theme in the 1.2 GeV electron linac project in Tohoku University, it has been concluded that aluminium alloy vacuum chambers can reduce exposure dose by about one or two figures as compared with stainless steel ones. Of course, aluminium alloy contains trace amounts of Mg, Si, Ti, Cr, Mn, Fe, Zn, Cu and others. Therefore, four kinds of aluminium alloy considered to be usable have been examined for induced radioactivity by electron beam irradiation. Stainless steel SUS 304 has been also irradiated for comparison. Radiation energy has been 30 MeV and 200 MeV. When stainless steel and aluminium alloy were compared, aluminium alloy was very effective for reducing surface dose in low energy irradiation. In 200 MeV irradiation, the dose ratio of aluminium alloy to stainless steel became 1/30 to 1/100 after one week, though the dose difference between these two materials became smaller in 100 days or more after irradiation. If practical inspection and repair are implemented during the period from a few days to one week after shutdown, the aluminium alloy is preferable for exposure dose reduction even in high energy irradiation.

4915 **(KFK—3729) Electrochemical investigation of the corrosion behavior of mild steel 1.0566 and soft iron in aqueous chloride solutions.** Schmitt, R.E.; Canadillas, F.; Koester, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). May 1984. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750012.

The authors describe electrochemical studies on the behaviour of 1.0566 in 0.1 M KCl and Q-brine (quinary salt mine brine) and the behaviour of soft iron in Q-brine at T = 35°C and 90°C. The corrosion potentials were determined by the open-circuit method and from the potentiodynamic current density/potential plot. The comparison of the corrosion behavior of (FK) in 0.1 M KCl and Q-brine makes evident that the O_2-content and the pH-value substantially influence the corrosion of (FK).

4916 **(NUREG/CR—3927) Charpy toughness and tensile properties of a neutron-irradiated stainless steel submerged arc weld cladding overlay.** Corwin, W.R.; Berggren, R.G.; Nanstad, R.K. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 34p. (ORNL/TM—9309). NTIS, PC A03/MF A01 - GPO. File Number TI85000409.

The cladding was applied to a pressure vessel steel plate by the submerged arc, single-wire, oscillating-electrode method. Three layers of cladding provided a thickness adequate for fabrication of test specimens. The first layer was type 309, and the upper two layers were type 308 stainless steel. The type 309 was diluted considerably by excessive melting of the base plate. Specimens were taken from near the base plate-cladding interface and also from the upper layers. Charpy V-notch and tensile specimens were irradiated at 288°C to a fluence of 2 x 10^{25} neutrons/m^2 (>1 MeV). When irradiated, both types 308 and 309 cladding increased 5 to 40% in yield strength and slightly increased in ductility in the temperature range from 25 to 288°C. All cladding exhibited ductile-to-brittle transition behavior during impact testing. The type 308 cladding, microstructurally typical of that in reactor pressure vessels, showed very little degradation in either upper-shelf energy or transition temperature due to irradiation. Conversely, the impact properties of the specimens containing the highly diluted type 309 cladding, microstructurally similar to that produced during some off-normal welding conditions in existing reactors, experienced significant increases in transition temperature and drops of up to 50% in upper-shelf energy. The impact energies of the Charpy specimens containing the type 309 layer strongly reflected the amount of the type 309 actually in the specimen, falling into two distinct high- and low-energy populations with the low-energy population corresponding to a higher fraction of type 309 in the specimen.

4917 **(PB—84-203298) Tensile and creep properties of DT2203Y05 dispersion-strengthened ferritic steel tubes.** Hendrix, W.; Vandermeulen, W. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Aug 1982. 30p. (BLG—557). NTIS, PC E04/MF E04.

This report contains results from tension, axial creep and internal pressure creep tests on tubes from several powder batches of the alloy DT2203Y05 prepared in the laboratory of the SCK/CEN. Its nominal composition is (wt.%)Ti-2.2, Mo-1.5, Cr-13, O-0.3, Y2O3-0.5, and Fe-the balance. Except for some tension test specimens the final heat treatment after cold drawing consisted of an annealing of 15 min. at 1050C (1323 K) followed by 1 day ageing at 800C (1073 K).

4918 **(PNL-SA—11270) Contributions of segregated phosphorus to the intergranular stress corrosion cracking of nickel.** Jones. R.H.; Danielson, M.J.; Bruemmer, S.M.; Baer, D.R.; Thomas, M.T. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1984. Contract AC06-76RL01830. 20p. (CONF-8310205—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003112.

From TMS-AIME fall meeting; Philadelphia, PA, USA (2 Oct 1983).

Phosphorus segregated to the grain boundaries of nickel has been observed to accelerate intergranular stress corrosion cracking (IGSCC) at passive and transpassive potentials in 1 N H_2SO_4 while sulfur had a negligible effect. Straining electrode tests of nickel with 0.26 monolayers of phosphorus or sulfur were conducted at potentials of +0.4 V to +2.0 V (SCE) and a strain rate of 2 x 10^{-6} s^{-1} while the crack growth rate-stress intensity relationships were measured with compact tension samples tested at +0.9 V (SCE). Crack tip chemistry estimates for a phosphorus enriched intergranular crack were made using a model by Turnbull. This analysis indicated that a potential drop of 40 mV would occur in a 2 mm long, 10 μm wide crack and that the solution at the crack tip would be saturated with nickel ions. Crack tip corrosion rate estimates were used in conjunction with a stress corrosion model by Parkins to indicate that the IGSCC rate was 10 to 180X faster than the calculated value. The discrepancy between the measured and calculated crack growth rates may reflect limitations in the crack

tip corrosion rate or crack growth rate modeling or a mechanical contribution to the crack growth rate. Differences between intergranular corrosion and stress corrosion tests show that the application of a stress caused intergranular cracks to be aligned perpendicular to the stress direction while intergranular corrosion crevices were randomly oriented. Also, intergranular stress corrosion cracks occurred at potentials of +0.4 to 1.5 V (SCE) while intergranular corrosion only occurred at potential greater than +1.4 V (SCE).

4919 **(SAND—83-2372C) Corrosion research of alloys for use in nuclear waste disposal canisters.** Sorensen, N.R.; Diegle, R.B. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-841120—1). NTIS, PC A02. File Number DE84006292.

From Workshop on corrosion performance of nuclear fuel waste containers; Ottawa, Canada (21 Nov 1984).

All tests involving the corrosion behavior of TiCode-12 (Ti-0.3Mo-0.8Ni) indicate that this alloy is a suitable choice for the containment of nuclear wastes. Although cracking was observed under conditions of hydrogen embrittlement, and pitting occurred in aggressive media, the conditions which produce these two failure modes represented severe overtests and are not expected in a repository. Both Mo and Ni increase the degree of corrosion resistance of Ti alloys. Mo changes the nature of the oxide, while Ni forms intermetallic precipitates which, through galvanic coupling, polarize the Ti into the passive region. All alternate alloys tested (including cast iron) exhibit acceptable corrosion behavior relative to their role as backup canister materials. In the case of cast iron, the material provides for a corrosion allowance design in contrast to the corrosion resistant design offered by Ti alloys. The effects of gamma irradiation still need to be adequately characterized. Research on such effects is underway at Sandia and the University of Minnesota. 11 references, 5 figures, 1 table.

4920 **Oxidation sulfidation resistance of FE-CR-NI alloys.** Natesan, K.; Baxter, D.J. (to Dept. of Energy). US Patent 4,470,848. 11 Sep 1984. Filed date 26 Jul 1983. vp. PAT-APPL-517474.

High temperature resistance of Fe-Cr-Ni alloy compositions to oxidative and/or sulfidative conditions is provided by the incorporation of about 1-8 wt. % of Zr or Nb and results in a two-phase composition having an alloy matrix as the first phase and a fine grained intermetallic composition as the second phase. The presence and location of the intermetallic composition between grains of the matrix provides mechanical strength, enhanced surface scale adhesion, and resistance to corrosive attack between grains of the alloy matrix at temperatures of 500°-1000° C.

4921 **Ultrasonic attenuation in UPt_3.** Bishop, D.J.; Varma, C.M.; Batlogg, B.; Bucher, E.; Fisk, Z.; Smith, J.L. (AT & T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **53**: No. 10, 1009-1011(3 Sep 1984).

We report measurements of the ultrasonic absorption in UPt_3 through the superconducting transition. The attenuation varies as T^2 at low temperatures and is inconsistent with the identification of UPt_3 as a singlet superconductor. Our results can be well explained by assum- ing that UPt_3 is an anisotropic (triplet) superconductor in a polarlike state, where the gap vanishes along a line on the Fermi surface.

4922 **Laser cutting nozzle.** Ramos, T.J. (to Dept. of Energy). US Patent 4,467,171. 21 Aug 1984. Filed date 30 Sep 1982. vp.

PAT-APPL-429921.

A laser cutting nozzle for use with a laser cutting apparatus directing a focused beam to a spot on a work piece. The nozzle has a cylindrical body with a conical tip which together have a conically shaped hollow interior with the apex at a small aperture through the tip. The conical hollow interior is shaped to match the profile of the laser beam, at full beamwidth, which passes through the nozzle to the work piece. A plurality of gas inlet holes extend through the body to the hollow interior and are oriented to produce a swirling flow of gas coaxially through the nozzle and out the aperture, aligned with the laser beam, to the work piece.

4923 **Irradiation-enhanced short-range ordering in austenitic stainless steel.** Stanley, J.T. (Arizona State Univ., Tempe (USA)); Cost, J.R. (Los Alamos National Lab., NM (USA)). *Journal of Physics F: Metal Physics;* **14**: No. 8, 1801-1810(Aug 1984).

Electrical resistance measurements were used to follow the change in short-range order of type-316 austenitic stainless steel. During irradiation at 713 K by ^{60}Co γ rays the rate of ordering increased due to the point defects introduced by the irradiation. However, when the point-defect concentration reached steady state the ordering rate was less than the ordering rate without irradiation. These observations are explained by a model in which vacancies diffuse faster than interstitials and diffusion of interstitials causes the state of local order to change away from its equilibrium value. Model calculations based on the standard chemical rate equations for vacancies and interstitials indicate that the vacancy diffuses about eight times faster than the interstitial at 713 K.

4924 **A controlled-unloading technique for determination of the long-range internal stress.** Holbrook, J.H.; Swearengen, J.C. (Battelle's Columbus Laboratories, Columbus, OH). *Scripta Metallurgica;* **18**: No. 6, 569-573(Jun 1984).

A new method is presented for measuring the internal stress of a metal for uniaxial deformation. The technique has the benefits that long times for measurement are not necessary nor are instantaneous load decrements. One drawback is that special electronic equipment is necessary to facilitate the experiments.

4925 **Developments of a powder-metallurgy, MZC copper-alloy, water-cooled gas turbine component.** Peterson, L.G. (General Electric Gas Turbine, Schenectady, NY). *Journal of Materials for Energy Systems;* **6**: No. 1, 50-58(Jun 1984).

The Department of Energy of the Federal Government has sponsored a technology development and verification testing program. This work is in support of an advanced, watercooled gas turbine firing at 2600°F (1427°C). As part of this turbine, strong emphasis has been placed on the design and testing of a composite first-stage nozzle. One of the materials making up this composite structure is a copper-alloy sublayer of Cu-MgZrCr (MZC). This alloy will serve as a heat-transfer medium to keep surface-metal temperatures, as well as internal temperature gradients, to acceptable levels. This paper discusses the development efforts that led to the selection of Cu-MgZrCr. Test results presented and compared to the design and processing goals in the High Temperature Turbine Technology program (HTTT). Composite nozzle fabrication via hot isostatic pressing and its effect on mechanical test properties and structure are also addressed.

4926 **The size of the sensitization zone in 304 stainless steel welds.** Tsai, N.S.; Eagar, T.W. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, MA). *Journal of Materials for Energy Systems;* **6**: No. 1, 33-37(Jun 1984).

Factors influencing the size and shape of the sensitization zone are studied through a statistically designed experiment. The width of the zone is in proportion to the magnitude of the heat input except when little fusion occurs. The minimum sensitization size can be obtained with a broadly distributed heat source traveling at high speed, and the maximum size can be obtained with low speed and a narrow heat distribution. Under certain welding conditions, one can obtain welds which are free of sensitization on the surface, hence this process may lead to a new method of preventing sensitization-induced intergranular corrosion. By depositing surface sensitization-free welds on either side of a previously sensitized weld, the chromium carbide precipitates dissolve and sensitization on the surface is eliminated.

4927 **Deuterium and helium trapping at TiC particles in ferritic steel.** Spitznagel, J.A. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)); Brenner, S.S.; Miller, M.K. (Steel Research Lab., Monroeville, PA (USA); Westinghouse Research and Development Center, Pittsburgh, PA (USA)); Choyke, W.J. (Westinghouse Research and Development Center, Pittsburgh, PA (USA); Pittsburgh Univ., PA (USA)). *Journal of Nuclear Materials;* **122**: No. 1-3, 252-253(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

First wall and blanket materials in Tokamak machines must accommodate increasing concentrations of helium and hydrogen isotopes. Alloy design principles point to the efficacy of trapping He and hydrogen at finely dispersed precipitates to minimize their impact on mechanical properties. Titanium carbide particles are known to trap He effectively in austenitic stainless steel. Less is known about TiC as a trap for helium and hydrogen isotopes in ferritic steels. This paper demonstrates the feasibility of directly measuring the trapping of helium and deuterium at TiC-ferrite interfaces using atom probe field ion microscopy.

4928 **Conditions for dislocation loop punching by helium bubbles.** Trinkaus, H. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.); Wolfer, W.G. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). *Journal of Nuclear Materials;* **122**: No. 1-3, 552-557(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Under continuous helium but insufficient vacancy supply, bubbles in metals grow by pressure-driven athermal processes such as metal interstitial emission and dislocation loop punching. To discuss the energetic conditions for these processes, the formation and interaction energies of bubbles and interstitial type metal defects are analyzed. The only condition which has been considered to data is that the decrease in the free energy of a bubble associated with the emission of an interstitial type metal defect must be equal to or larger than the formation free energy of the latter defect. Consideration of the elastic interaction energies result in additional conditions controlling loop punching for bubbles with radii larger than about 10 Burgers vectors. Possible modes for the loop punching process are discussed.

4929 **Constitutive design equations for thermal creep deformation of HT-9.** Amodeo, R.J.; Ghoniem, N.M. (California Univ., Los Angeles (USA). Center for Plasma Physics and Fusion Engineering). *Journal of Nuclear Materials;* **122**: No. 1-3, 91-95(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

In this paper, we present the results of analysis of data provided by SANDVIK Steel Research Center for the high temperature properties of HT-9 (Cr12MoV steel). We develop design equations for use in inelastic structural mechanics applications, for the most important thermal creep parameters. Empirical correlations for creep rupture time and the complete description of elongation vs. time are presented. A phenomenological description of steady-state creep is also developed. It is found that dislocation creep can explain the measured data.

4930 **Tensile and low-cycle fatigue measurements on cross-rolled tungsten at 1505 K.** Schmunk, R.E.; Korth, G.E. (EG and G Idaho, Inc., Idaho Falls (USA)); Ulrickson, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Journal of Nuclear Materials;* **122**: No. 1-3, 850-854(May 1984). (CONF-830942—). Contract AC07-76ID01570.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report EGG-M--18083; CONF-830942--31.

Tungsten continues to be considered for use in fusion reactors because of its mechanical properties, good thermal shock resistance, and relatively high thermal conductivity. Low-cycle fatigue and tensile tests have been made at 1505 K on specimens fabricated from 12.7-mm thick cross-rolled tungsten plate which was prepared by a powder metallurgy process. All tests were made in vacuum, and the fatigue tests were made in strain control. The experimental fatigue data agree fairly well with the 'universal slopes' equation, giving a slightly lower number of cycles to fail than predicted by the equation for a given strain range. Details of the test procedure are reported along with the experimental results. These data should support continued design work where tungsten is considered for application in pulsed reactor systems.

4931 **Radiation induced phosphorus segregation in austenitic and ferritic alloys.** Brimhall, J.L.; Baer, D.R.; Jones, R.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Journal of Nuclear Materials;* **122**: No. 1-3, 196-200(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report PLN-SA--11321; CONF-830942--53.

The radiation induced surface segregation (RIS) of phosphorus in stainless steel attained a maximum at a dose of 0.8 dpa then decreased continually with dose. This decrease in the surface segregation of phosphorus at high dose levels has been attributed to removal of the phosphorus layer by ion sputtering. Phosphorus is not replenished since essentially all of the phosphorus within the irradiation zone has been segregated to the surface. Sputter removal can explain the previously reported absence of phosphorus segregation in ferritic alloys irradiated at high dosessup(1,2) (>1 dpa) since irradiation of ferritic alloys to low doses has shown measurable RIS. This sputtering phenomenon places an inherent limitation to the heavy ion irradiation technique for the study of surface segregation of impurity elements. The magnitude of the segregation in ferritics is still much less than in stainless steel which can be related to the low damage accumulation in these alloys.

4932 **In-situ observation of cavity growth process in HVEM irradiated 316 stainless steel.** Igata, N.; Kohyama, A.; Kohno, Y.; Suzuki, K. (Tokyo Univ. (Japan). Dept. of Materials Science); Ayrault, G. (Argonne National Lab., IL (USA). Materials Science Div.; Tokyo Univ. (Japan). Dept. of Materials Science). *Journal of Nuclear Materials;* **122**: No. 1-3, 214-218(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

In-situ observations of the cavity growth process in dual-ion irradiated and/or electron irradiated samples were performed by a HVEM. The objective of this study is to analyze cavity growth mechanisms as functions of cavity size and of injected helium concentration. The materials used were 20% cold-worked and solution annealed and aged 316 SS. Electron irradiation to dual-ion irradiated samples caused rapid growth of cavities larger than the critical size. Electron irradiation to helium preinjected samples produced bi-modal cavity size distributions. Without helium preinjection, electron irradiation produced uni-modal cavity size distributions with most cavities larger than the critical size. These results provide clear evidence of bias-driven and pressure-driven cavity growth mechanism.

4933 **Microstructural evolution in dual-ion irradiated 316 SS under various helium injection schedules.** Kohyama, A.; Igata, N. (Tokyo Univ. (Japan). Dept. of Materials Science); Ayrault, G. (Argonne National Lab., IL (USA). Materials Science Div.; Tokyo Univ. (Japan). Dept. of Materials Science). *Journal of Nuclear Materials;* **122**: No. 1-3, 224-229(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Dual-ion irradiated 316 SS samples with various helium injection schedules were studied. The intent of using different schedules was to either approximate the MFR condition, mimic the mixed spectrum reactor condition or mimic the fast reactor condition. The objective of this investigation is to study the influence of these different helium injection schedules on the microstructural development under irradiation. The materials for this study was 316 SS (MFE heat) with three thermomechanical pre-irradiation treatments: solution annealed, solution annealed and aged and 20% cold worked. The cavity nucleation and growth stages were investigated using high resolution TEM.

4934 Effects of pulsed and/or dual ion irradiation on microstructural evolution in a Ti and Si modified austenitic alloy. Hishinuma, A. (Japan Atomic Energy Research Inst., Tokai, Ibaraki); Packan, N.H.; Lee, E.H.; Mansur, L.K. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.). *Journal of Nuclear Materials;* **122**: No. 1-3, 260-265(May 1984). (CONF-830942—). Contract W-7405-ENG-26.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report CONF-830942--67.

The influence of pulsed 4 MeV Ni-ion bombardment, with and without simultaneous helium injection, at 958 K and damage levels from 1 to 50 dpa has been studied in a low swelling, Ti- and Si-modified austenitic stainless steel. Compared to continuous irradiation, pulsing caused an increase in the number density of interstitial loops formed during irradiation. Helium also increased the nucleation of interstitial loops. The main precipitates formed were a large number of small TiC particles uniformly distributed in the matrix, and a small number of relatively large eta and G precipitates. These coarse precipitates were somewhat larger in the pulsed specimens. Pulsing appeared to produce no significant change in swelling compared to continuous irradiation.

4935 Radiation hardening of oxygen-doped niobium by 14 MeV neutrons. Bradley, E.R.; Jones, R.H. (Battelle Pacific Northwest Labs., Richland, WA (USA)). *Journal of Nuclear Materials;* **122**: No. 1-3, 402-406(May 1984). (CONF-830942—). Contract AC06-76RL01830.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report PNL-SA--11320; CONF-830942--13.

The flow properties of niobium containing 185 and 480 wt ppm oxygen have been studied following irradiation at 300 K with T(d,n) neutrons. Two hardening stages connected by a plateau region were observed in the niobium containing 185 wt ppm oxygen. Increasing the oxygen content by 300 wt. ppm oxygen shifted the beginning of the high-fluence hardening stage, thereby eliminating the plateau region. This shift resulted in 1.5 times more hardening in the oxygen-doped niobium irradiated to fluence levels above 5×10^{21} m^{-2}.

4936 Dislocation sweeping of defects in neutron- and electron-irradiated niobium. Loomis, B.A.; Otero, M.P. (Argonne National Lab., IL (USA). Materials Science Div.; Argonne National Lab., IL (USA). Engineering and Technology Div.). *Journal of Nuclear Materials;* **122**: No. 1-3, 427-428(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report CONF-830942--69.

The glide of dislocations in oriented Nb single crystals irradiated at 325 K with 5.5×10^{21} neutrons/m^2 (E>0.1 MeV) is investigated for increasing time of tensile elongation in the High Voltage Electron Microscope at Argonne National Laboratory. An electron energy of 900 keV was used during the simultaneous deformation and TEM observation.

4937 Slow strain rate stress corrosion cracking under multiaxial deformation conditions: technique and application to admiralty brass. Blanchard, W.K.; Heldt, L.A.; Koss, D. (Department of Metallurgical Engineering, Michigan Technological University, Houghton, Michigan). *Corrosion (Houston);* **40**: No. 3, 101-104(Mar 1984).

A set of straightforward experimental techniques are described for the examination of slow strain rate stress corrosion cracking (SCC) of sheet deforming under nearly all multiaxial deformation conditions which result in sheet thinning. Based on local fracture strain as a failure criterion, the results contrast stress corrosion susceptibility in uniaxial tension with those in both plane strain and balanced biaxial tension. These results indicate that the loss of ductility of the brass increases as the stress state changes from uniaxial toward balanced biaxial tension.

4938 Analysis of diffraction from (001) twist boundaries in cubic metals. Brokman, A.; Balluffi, R.W. (Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge). *Acta Metallurgica;* **31**: No. 10, 1639-1647(Oct 1983).

An analysis of the diffraction from (001) twist boundaries in cubic metals has been made using analytical methods. A simple model for boundary structure involving rotational relaxations around O lattice elements in the boundary core was employed. The results yielded grain boundary diffracted intensity on a grain boundary diffraction lattice in reciprocal space. This lattice consisted of an array of line elements running parallel to the twist axis in a square pattern corresponding to the reciprocal lattice of the coincidence site lattice lying parallel to the grain boundary plane. The analytical model predicted the main features of experimentally observed diffracted intensities and also those obtained by computer simulation and revealed the physical origins of the diffraction effects. The generalization of the analytical model to include any type of boundary was indicated.

4939 A damage model of creep crack growth in polycrystals. Thouless, M.D.; Evans, A.G.; Hsueh, C.H. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory University of California, Berkeley, CA). *Acta Metallurgica;* **31**: No. 10, 1675-1687(Oct 1983).

A model for the growth of cracks by cavitation has been developed in which the effect of a viscous constraint has been considered. The important parameters are grain size (l) and viscosity (/ eta/) of the material, the applied stress intensity factor (K), the size of the damage zone (z), spacing of the cavities (λ) and the size at which they coalesce (A_1, /SUB f/). The velocity of the crack is predicted by this model to be proportional to K and inversely proportional to /eta/. Its dependence upon the grain size is more complex and can vary between a l /SUP -5/2/ and a l /SUP 1/2/ . The influence of the constraint has been shown to be important only for small damage zones, and high values of both the relative cavity spacing (l/λ) and the cavity area at coalescence. Otherwise, the crack velocity tends to the values predicted in the absence of constraint.

4940 Application of a model for strain aging under stress to niobium. Reed-Hill, R.E.; Beckerman, L.P.; Park, S.C. (Department of Materials Science and Engineering, University of Florida, Gainesville, FL). *Acta Metallurgica;* **31**: No. 10, 1715-1720(Oct 1983).

A simple model is proposed to rationalize yield point return curves obtained when specimens of a b.c.c. metal-interstitial atom solid solution are strain aged under stress. Several basic assumptions are involved. First that the solute is mobile enough to diffuse to the dislocations and strain age them during the period that they wait in front of obstacles to their motion for thermal activation (Sleeswyk's hypothesis). Second, the solute is not mobile enough to be dragged with the dislocations as they advance between obstacles. Third, the stress increment due to the strain aging of the dislocations is additive to the stress of the basic rate controlling mechanism. Fourth, in agreement with experimental observations, the strain again follows conventional static strain aging kinetics involving both Shoeck-Seeger (Snoek) reordering of the solute in the stress fields of the dislocations and the long range Cottrell-Bilby drift of the solute to form dislocation atmospheres. Tests of the model using niobium-oxygen data taken from the literature demonstrate that it is able to account, for the effects of both temperature and prestrain on the strain aging under stress kinetics curves.

4941 Effect of sulfur segregation and hydrogen charging on intergranular fracture of iron. Shin, K.S.; Meshu, M. (Department of Materials Science and Engineering, Northwestern University, Evanston, IL). *Acta Metallurgica;* **31**: No. 10, 1559-1566(Oct 1983).

The effect of sulfur segregation and hydrogen charging on grain boundary strength was investigated by a slow strain-rate tensile test at 77 K. The amount of sulfur segregation at grain boundaries was controlled by varying the initial purity of specimens and quenching temperature and was determined by Auger electron spectroscopy after in situ fracture under ultra-high vacuum. The

effect of hydrogen on grain boundary strength was examined at various grain boundary sulfur and/or hydrogen contents. The deleterious effects were independent and additive. The reversible effect is attributed to the reduction in the cohesive strength of grain boundaries due to atomic hydrogen whereas the irreversible effect is attributed to the damage due to molecular hydrogen precipitation.

4942 **An examination of grain boundary migration during high temperature fatigue of aluminum--I. Microstructural observations.** Yavari, P.; Langdon, T.G. (Departments of Materials Science and Mechanical Engineering, University of Southern California, Los Angeles, CA). *Acta Metallurgica;* **31**: No. 10, 1595-1603(Oct 1983).

Experiments were conducted on polycrystalline A1 under conditions of low cycle fatigue at 573 K, microscopic examination showed that the grain boundaries migrate in a regular and cyclic manner. If a specimen experiences a total of N cycles of loading with or without an interruption in the test and if migration occurs only in the forward direction, each migrating boundary exhibits one faint boundary trace plus (N + 1) sharp markings, where the faint trace denotes the initial position of the boundary and the (N + 1) sharp markings are surface steps corresponding to the separate positions taken up by the boundary during testing. The extra migration marking is introduced in the first half-cycle of the test, and thereafter the completion of each cycle gives rise to one additional marking. If some migration occurs in the reverse direction, there are a total of (N + 1 + M) sharp markings at each boundary, where M is the number of migration reversals which is equal to the number of segments of material essentially extruded from the specimen surface. Models are described which explain the observations.

4943 **An examination of grain boundary migration during high temperature fatigue of aluminum--II. Measurements of migration.** Yavari, P.; Langdon, T.G. (Departments of Materials Science and Mechanical Engineering, University of Southern California, Los Angeles, CA). *Acta Metallurgica;* **31**: No. 10, 1605-1610(Oct 1983).

4944 **Flux pinning for in situ Nb_3Sn superconducting wire.** Verhoeven, J.D.; Finnemore, D.K.; Gibson, E.D.; Ostenson, J.E.; Sue, J.J. (Ames Laboratory, USDOE, Department of Materials Science and Engineering). *Acta Metallurgica;* **31**: No. 8, 1233-1241(Aug 1983).

Critical currents and upper critical fields have been evaluated in order to determine which aspects of filament morphology are most important for flux pinning. Wire specimens were prepared with a wide range of Nb_3Sn filament sizes as controlled by the as-cast dendrite size, the degree of wire drawing and the degree of filament coarsening. Tape specimens were examined as a function of orientation in the magnetic field. The Nb_3Sn filament and grain morphology were examined with SEM and TEM techniques. In all cases the pinning force was found to follow an h /SUP 1/2/ (1-h)^2 dependence where h is the reduced magnetic field, H/H /SUB c2/ and the data consistently yielded parallel lines on a Kramer plot. Neither the perfect lattice shear model of Kramer nor the surface pinning model of Dew-Hughes adequately describe in situ data. Analysis and the Nb_3Sn filament and grain morphology indicates that flux pinning is not dominated by either the Nb_3Sn/Bronze interfaces or the Nb_3Sn grain boundaries, but is probably due to a combination of pinning at both interfaces.

4945 **Dislocation enhancement and inhibition induced by films on crack surfaces.** Paskin, A.; Dienes, G.J.; Sieradzki, K.; Som, D.K. (Queens College of CUNY, Flushing, NY). *Acta Metallurgica;* **31**: No. 8, 1253-1265(Aug 1983).

Computer simulations were used to study the propagation of cracks coated with thin solid films in a 2D triangular Lennard-Jones solid. The key parameter investigated was the mismatch in the interatomic distances of the film and the substrate (the eleastic moduli were kept the same). The major result is that "Large Film Atoms," i.e. interatomic distance in the film larger than in the substrate, promote dislocation generation at the film-substrate interface while "Small Film Atoms" inhibit dislocation formation and promote brittle fracture in an otherwise ductile material. The critical applied load to cause fracture decreased significantly with increasing film thickness. These results are in qualitative agreement with some currently available experimental data. A model was developed which explains the simulation results in terms of the residual stresses resulting from the "atomic size" mismatch of film and substrate. The fact that cracks propagated brittly in the substrate after the film was ruptured is explained in terms of a model for dynamic embrittlement.

4946 **A d-band bonding theory of the relative heats of solution of transition metal alloys and its relationship to solubility limits.** Watson, R.E.; Bennett, L.H.; Goodman, D.A. (Brookhaven National Laboratory, Upton, NY). *Acta Metallurgica;* **31**: No. 8, 1285-1291(Aug 1983).

The relative heats of solution of a transition metal in another and vice versa are derived within a Friedel d-band bonding model. The trend found in the heats parallels the trend observed previously in experimental relative solubilities. The implication of the solubility trend for surface segregation is also discussed.

4947 **Vacancy formation in Ni and Ni(Ge).** Smedskjaer, L.C.; Fluss, M.J.; Legnini, D.G.; Chason, M.K.; Siegel, R.W. (Argonne National Lab., IL (USA)). pp 449-452, 525 of Proceedings of Yamada conference 5 on point defects and defect interactions in metals. Takamura, Jin-ichi (Kyoto Univ. (Japan). Faculty of Engineering); Doyama, Masao; Kiritani, Michio (eds.). Tokyo, Japan; Univ. of Tokyo Press (1982). (CONF-811150—).

From Yamada conference on point defects and defect interactions in metals; Kyoto, Japan (16 Nov 1981).

Vacancy formation in Ni and Ni(1 at% Ge) was studied under thermal equilibrium conditions using positron annihilation Doppler-broadening. A monovacancy formation enthalpy of 1.8 +- 0.1 eV was determined for pure Ni; combining this result with those from previous tracer self-diffusion measurements, a monovacancy migration enthalpy of 1.1 +- 0.1 eV was also deduced. An effective vacancy formation enthalpy of 1.4 eV was found for Ni(1 at% Ge). Using a model to simulate the free and bound-vacancy ensemble in the alloy, a value of 0.7 eV was obtained for the formation enthalpy of Ge-bound vacancies. The results are compared with previous theoretical and experimental results.

4948 **Atomic defects and diffusion in metals.** Siegel, R.W. (Argonne National Lab., IL (USA)). pp 533-540, 602-603 of Proceedings of Yamada conference 5 on point defects and defect interactions in metals. Takamura, Jin-ichi (Kyoto Univ. (Japan). Faculty of Engineering); Doyama, Masao; Kiritani, Michio (eds.). Tokyo, Japan; Univ. of Tokyo Press (1982). (CONF-811150—).

From Yamada conference on point defects and defect interactions in metals; Kyoto, Japan (16 Nov 1981).

The self-diffusion data for fcc and refractory bcc metals are briefly reviewed with respect to (i) the available monovacancy formation and migration properties and (ii) the high-temperature diffusion enhancement above that expected for mass transport via atomic exchange with monovacancies. While the atomic-defect mechanism for low-temperature self-diffusion can be attributed to monovacancies, the mechanisms responsible for high-temperature mass transport are not so easily defined at present; both divacancies and interstitials must be seriously considered. Possibilities for improving our understanding are discussed.

4949 **Molecular dynamics simulation of displacement cascades in Cu. Analysis of replacement sequences.** King, W.E.; Benedek, R. (Argonne National Lab., IL (USA)). pp 807-810, 833-834 of Proceedings of Yamada conference 5 on point defects and defect interactions in metals. Takamura, Jin-ichi (Kyoto Univ. (Japan). Faculty of Engineering); Doyama, Masao; Kiritani, Michio (eds.). Tokyo, Japan; Univ. of Tokyo Press (1982). (CONF-811150—).

From Yamada conference on point defects and defect interactions in metals; Kyoto, Japan (16 Nov 1981).

Molecular dynamics computer simulations of displacement cascades in copper have been performed for recoil energies up to 450 eV. Statistical analyses of the atomic replacements are presented. Linear replacement sequence lengths are extremely short on the average. The effect of the cooling phase of the cascade is discussed.

4950 **Using diffusion measurements to determine pore-size distributions in porous materials.** Brown, L.F.; Travis, B.J. (Los Alamos Scientific Lab.). *AIChE Paper;* No. 1A, 1-19(1980). (CONF-800610—).

From American Institute of Chemical Engineering conference; Philadelphia, PA, USA (8 Jun 1980).

The internal structure of the porous solid was modeled as nonintersecting cylindrical pores of random directions. A relationship was derived for the flux as a function of pressure in which the flux is a functional of the pore size distribution. The resulting Fredholm integral equation of the first kind was solved for the diffusion region between Knudsen and bulk diffusion, which can be measured by Wicke-Kallenbach experiments. Calculations of pore size distributions of hypothetical materials with ideal simple or bimodal pore distributions for 0.1-2.0 MPa and 0.1-30.0 MPa showed the validity of the method. The method also predicted the diffusion as a function of pressure in Girdler G-3B porous catalyst, for which Wicke-Kallenbach data were available, but calculated results deviated for the pore size distribution based on available mercury porosimeter data for the same catalyst.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 3602004580, 5011

4951 **(CONF-841184—8) Magnetic and Moessbauer studies on $GdCo_3B_2$ and $DyCo_3B_2$.** Malik, S.K.; Umarji, A.M.; Shenoy, G.K. (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003037.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

Magnetization and Moessbauer studies have been carried out on $GdCo_3B_2$ and $DyCo_3B_2$. These compounds are magnetically ordered with Curie temperatures of 56° and 21°K respectively. The Co atoms are either nonmagnetic or carry a small moment in these compounds. The saturation moment of $DyCo_3B_2$ at 5°K is smaller than the Dy^{3+} free-ion value. From ^{161}Dy Moessbauer studies, the measured hyperfine magnetic field at the Dy site is also observed to be smaller than the free-ion value. ^{155}Gd Moessbauer measurements in $GdCo_3B_2$ reveal the presence of large crystalline electric fields at the rare earth site. This causes the moment and the hyperfine field at the Dy site in $DyCo_3B_2$ to be reduced from its free-ion value.

4952 **(IS-M—519) Investigation of vanadium solid solution and zeta phase regions of vanadium-carbon system.** Ghaneya, A.H.; Carlson, O.N. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 20p. (CONF-8409179—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002678.

From American Institute of Mining, Metallurgical and Petroleum Engineers conference; Detroit, MI, USA (17 Sep 1984).

The vanadium-rich solvus of the V-C system was determined for the temperature range of 1100 to 1650°C. The solubility decreases from a maximum of 4.3 at. % C at 1650°C to 0.5 at. % C at 1100°C. The heat of solution for carbon in vanadium was determined to be 83.7 kJ mol^{-1}. No evidence was found for the postulated ordered phase $V_{64}C$ from TEM, microscopic or electron diffraction studies. The existence of a zeta phase having the stoichiometry V_4C/sub 3-x/ where x = 0.33 was confirmed by x-ray and metallographic evidence. Its peritectoid decomposition temperature was determined by differential thermal analysis to be 1320 +- 10°C. The hardness of quenched V-C alloys increases monotonically with carbon content over the range of 0.02 to 0.64 at. % C. Quenched alloys aged at 300°C for different times show a maximum in the hardness at about one hour.

4953 (ND-R—921(S), pp 62-65) **High temperature SANS [small angle neutron scattering] studies of doped uranium oxide.** Hardy, A.D. (UKAEA Springfields Nuclear Power Development Labs.). Sep 1983. HMSO, London, England Pound 6.00. (CONF-8209257—).

From 30. UKAEA diffraction analysis conference; Oxford, UK (28 Sep 1982).

The aim of the experiments was to use small angle neutron scattering (SANS) to characterise microstructural changes in the dopant of variously doped uranium dioxide as the sample temperature was raised. The size and density of the dopant particles were determined at temperatures not greater than 1600°C. Any observed bulk microstructural changes were related to the in-reactor properties of nuclear fuel. Various dopants such as niobia, titania, magnesia and chromia were used.

4954 (PNCT—831-81-01, pp 26-36) **Sintering kinetics of plutonium-uranium mixed oxide.** Kinugasa, Manabu; Kawamata, Kazuhiko; Kashima, Sadamitsu (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980 - Mar 1981.

In the sintering of ceramics, the powder characteristics and heating conditions markedly influence the sinterability. The study on the sintering phenomena of Pu-U mixed oxide has been scarcely reported. In this study, the sintering of Pu-U mixed oxide powder compacts having different particle size distribution was carried out, and the sintering mechanism was examined by the shrinkage of the compacts during sintering. Four types of the mixed oxide powder with the composition of Pu(0.285) U(0.715) O_2 were prepared, and their physical properties and scanning electron micrographs were examined. Cylindrical green pellets were made, and sintered from 900 to 1700 deg C. The density and shrinkage of the pellets were calculated with their dimensions and weight. The density increased with the decrease of recovered powder content above 1300 deg C. Regardless of the amount of recovered powder added, the shrinkage began around 900 deg C, and progressed remarkably in the range from 1100 to 1300 deg C. In the range from 900 to 1100 deg C, the mechanism controlling the sintering has changed from grain boundary diffusion to volume diffusion. The effect of atmosphere on the rate of shrinkage was examined. The sinterability of Pu-U mixed oxide is promoted in its hyperstoichiometric state.

4955 (PNCT—831-81-01, pp 37-42) **Powder properties observed by scanning electron microscopy.** Masuyama, Teikichi; Senda, Shigehisa; Yokosuka, Yoshifumi; Yokosawa, Naoki; Kaya, Akira (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). Sep 1981. NTIS (US Sales Only), PC A07/MF A01. File Number TI83900415.

In Annual progress report of Power Reactor and Nuclear Fuel Development Corporation, Tokai Works. Apr 1980 - Mar 1981.

It is important to study powder properties for producing the pellets meeting the rigid requirements. Usually specific area, average diameter, tap density, bulk density and so on are measured, but there is no adequate method to determine sintering density and ceramographical characters. In this paper, the scanning electron microscopic data on the powders usually used in the plutonium facilities in Power Reactor and Nuclear Fuel Development Corp. are shown. A SEM apparatus was installed in an existing glove box, and it was designed to operate at the rate of 8 samples per 3 hours. Its features are described. PuO_2 powder has such high purity that it is a good electric insulator. As the specimens for SEM must have some conductivity, it is coated with Au. There are two types of Pu raw materials, imported pure PuO_2 powder and co-converted powder. UO_2 powder is made from uranyl nitrate or UF_6. The SEM photographs of these powders together with recovered powder and ball-milled powder are shown. The ceramographies of sintered pellets frequently showed large round particles delineated with cavities. The particles appear in case of the powder which was press-rolled or previously pressed, crushed and sieved.

4956 **Broadband reduced reflectivity on silica using etched nuclear tracks.** Hopper, R.W. (University of California, Lawrence Livermore Laboratory, P.O. Box 5508, Livermore, California 94550). *Applied Optics;* 23: No. 16, 2763-2769(15 Aug 1984).

The use of etched nuclear tracks to create a gradient-index antireflective surface on fused silica was investigated. Fission fragments were used as the nuclear particles. The long-wavelength antireflectivity achieved was broadband but modest, possibly because

of large index gradients at the internal and external surfaces. Transmission at short wavelengths was limited by diffuse surface scatter. Laser damage thresholds were high. Residual radioactivity was significant but tolerable for some applications. A theory of the index profile of the porous surface was developed.

4957 **Phase changes in the niobium-hydrogen system--III. Acoustic studies of hydride phase transitions at H/Nb = 0.78.** Amano, M.; Birnbaum, H.K.; Mazzolai, F.M. (Department of Metallurgy and Mining Engineering, University of Illinois at Urbana-Champaign, Urbana, IL). *Acta Metallurgica;* **31**: No. 10, 1549-1557(Oct 1983).

Ultrasonic techniques were used to measure the moduli and attenuation of single crystals of NbH /SUB 0.78/ composition over the temperature range 77-525K. Sufficient acoustic modes were measured to allow determination of all of the cubic moduli for the α' (b.c.c.) phase and the orthorhombic moduli for the β and ϵ phases. Softening of the moduli and increases of the attenuation were observed near the α'-β transition. Discussion of these results is based on a Zener relaxation mechanism and a Landau model for a second-order phase transition. The moduli and attenuation near the β-ϵ transition did not exhibit any precursor behavior. Relaxations above the β-ϵ transition are interpreted on the basis of H density fluctuations in the β phase.

4958 **High temperature failure initiation in liquid phase sintered materials.** Marion, J.E.; Clarke, D.R.; Drory, M.D.; Evans, A.G. (Department of Materials Science University of California, Berkeley, CA). *Acta Metallurgica;* **31**: No. 10, 1445-1457(Oct 1983).

The mechanisms for initiation of high temperature failure in liquid-phase sintered (L.P.S.) ceramics are investigated. Results of a transmission electron microscopy study on silicon nitride exposed to creep strains at elevated temperature are used to propose a sequence for the early stages of cavitation damage, physical expressions are derived for the growth and coalescence times for oblate holes in thinglass films along two-grain interfaces. The times for formation of spherical holes along three-grain channel glass pockets and their subsequent growth to full-facet sized cavities by viscous flow and solution/reprecipitation mechanisms are evaluated. In combination, the failure expressions constitute the first step in the development of a time-to-failure model for high temperature deformation of L.P.S. ceramics.

4959 **Dielectric relaxation in yttria-doped ceria solid solutions.** Wang, D.Y.; Nowick, A.S. (Columbia Univ., NY). *Journal of Physics and Chemistry of Solids;* **44**: No. 7, 639-646(1983). Contract AC02-78ER04693.

The nature of the defects present in Y_2O_3-doped CeO_2 is explored by means of dielectric relaxation, employing primarily the thermally-stimulated depolarization current (TSDC) technique. For Y_2O_3 concentrations $\leqq$ mole %, two relaxation peaks are observed. The lower-temperature peak shows a dielectric relaxation rate, tau^{-1}, which is 1/2 the relaxation rate of the corresponding anelastic relaxation, illustrating that the peak is due to nn, (111) oriented, (Y V/sub o/) pairs; V/sub o/ represents the oxygen vacancy. These pairs are positively charged defects which are compensated by an equal number of isolated Y'. The upper peak is a broad peak whose position varies with Y_2O_3 concentration in the same manner as the activation enthalpy for the ionic conductivity. The peak is not due to simple dipoles, but to relaxation of the array of alternately charged (Y V/sub o/) and Y' defects by the redistribution of oxygen-ion vacancies. A simple model, in which these defects form a superlattice containing wrong pairs, explains the essential features of the upper peak.

3603 Composite Materials

REFER ALSO TO CITATION(S) 3603004875

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 3604004579, 4579

4960 **(AD-A—143202/0) NMR, electrical relaxation, and high pressure electrical conductivity in ion conducting polymers. Interim technical report.** Fontanella, J.J.; Wintersgill, M.C.; Greenbaum, S.G. (Naval Academy, Annapolis, MD (USA). Dept. of Physics). May 1984. 29p. (TR—14). NTIS, PC A03/MF A01.

Prepared in cooperation with Hunter Coll., New York.

Recent nuclear magnetic resonance (NMR), electrical relaxation, and high pressure electrical conductivity studies of ion conducting polymers are reviewed. Most of the work discussed is that concerned with poly(ethylene oxide) (PEO) though some recent results concerning poly(vinyl acetate) are also described. A survey of experimental 1H, 7Li, 19F, and 23Na NMR data for ion conducting polymers based on PEO reveals some features that are commonly observed in supersonic solids, such as motional narrowing in the temperature region of enhanced conductivity. The NMR activation energies are generally lower than those for conductivity, indicating the presence of localized motional processes. Previous electrical relaxation data along with new results for PE04.5:NaI and PE04.5:LiCF3S03 make it clear that PEO complexed with different salts exhibits different electrical relaxation spectra. Changes in chain structure are detected along with multiphase behavior. Also, new results are presented for the effect of high pressure on the electrical conductivity of poly(propylene oxide) complexed with alkali metal salts. Those results eliminate some ambiguities associated with previous high pressure electrical conductivity studies of PEO.

4961 **Fractal geometry of silica condensation polymers.** Schaefer, D.W.; Keefer, K.D. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **53**: No. 14, 1383-1386(1 Oct 1984). Contract AC04-76DP00789.

The fractal dimension, D, of branched silica polymers is measured by small-angle x-ray scattering. D is independent of branching ratio and does not change during the course of polymerization to a gel.

3606 Other Materials

REFER ALSO TO CITATION(S) 3606004455, 4639, 4950

4962 **(AERE-R—11127) Investigation of thermally induced anion disorder in fluorites using neutron scattering techniques.** Hutchings, M.T.; Clausen, K.; Dickens, M.H.; Hayes, W.; Kjems, J.K.; Schnabel, P.G.; Smith, C. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Nov 1983. 97p. (MPD/NBS—244). UKAEA, Materials Physics Div., AERE Harwell, Oxfordshire, England. File Number TI85900269.

Some materials with the fluorite structure show a pronounced specific heat anomaly well below their melting temperature. This anomaly is a consequence of lattice disorder and is associated with the onset of fast-ion conduction. This paper presents the results of a series of experiments in which the coherent diffuse quasielastic neutron scattering from three such fluorite compounds PbF_2, $SrCl_2$ and CaF_2, was investigated. The diffuse scattering intensity, and its energy width, increase with temperature into the fast-ion phase, and when integrated over energy transfer the intensity exhibits a characteristic variation with scattering vector, falling on an anisotropic shell in reciprocal space and peaking in certain directions. The diffuse intensity indicates that dynamic correlations exist between the defective anions in the fast-ion phase. A model of short-lived clusters comprising anion Frenkel interstitials, anion vacancies and relaxed anions has been developed which satisfactorily accounts for the distribution of intensity. The energy width of the

diffuse scattering indicates that the lifetime of the clusters, ≃ 10^{-12} sec, decreases as the temperatures increases, and in the case of $SrCl_2$ and CaF_2 it exhibits a variation with scattering vector which suggests that the lattice imposes translational correlations in the time evolution of the clusters. The cluster model is shown to also account quite well for both the absolute intensity and lifetime of the clusters, and suggests that the concentration of Frenkel defects is ≃ 5% at T/sub c/, the temperature at which the specific heat peaks. These numbers are consistent with estimates made from neutron diffraction and recent analysis of specific heat data. 74 references, 10 figures, 8 tables.

4963 **(BNL-NUREG—35285) Nonlinear failure analysis of a reinforced concrete containment under internal pressure.** Sharma, S.; Wang, Y.K.; Reich, M. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 18p. (CONF-8406124—14). NTIS, PC A02/MF A01 - GPO. File Number TI85000877.

From 2. workshop on containment integrity; Crystal City, VA, USA (13 Jun 1984).

A detailed nonlinear finite element model is used to investigate the failure response of the Indian Point containment building under severe accident pressures. Refined material models are used to describe the complex stress-strain behavior of the liner and rebar steels, the plain concrete and the reinforced concrete. Structural geometry of the containment is idealized by eight layers of axisymmetric finite elements through the wall thickness in order to closely model the actual placement of the rebars. Soil stiffness under the containment base mat is modeled by a series of nonlinear spring elements. Numerical results presented in the paper describe cracking and plastic deformation (in compression) of the concrete, yielding of the liner and rebar steels and eventual loss of the load carrying capacity of the containment. The results are compared with available data from the previous studies for this containment. 8 references, 9 figures.

4964 **(CONF-841157—16) Extrapolation of nuclear waste glass aging.** Byers, C.D.; Ewing, R.C.; Jercinovic, M.J.; Keil, K. (Argonne National Lab., IL (USA); New Mexico Univ., Albuquerque (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02. File Number DE85002772.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Increased confidence is provided to the extrapolation of long-term waste form behavior by comparing the alteration of experimentally aged natural basaltic glass to the condition of the same glass as it has been geologically aged. The similarity between the laboratory and geologic alterations indicates that important aging variables have been identified and incorporated into the laboratory experiments. This provides credibility to the long-term predictions made for waste form borosilicate glasses using similar experimental procedures. In addition, these experiments have demonstrated that the aging processes for natural basaltic glass are relevant to the alteration of nuclear waste glasses, as both appear to react via similar processes. The alteration of a synthetic basaltic glass was measured in MCC-1 tests done at 90°C, a SA/V of 0.1 cm^{-1} and time periods up to 182 days. Tests were also done using (1) MCC-2 procedures at 190°C, a SA/V of 0.1 cm^{-1} and time periods up to 91 days and (2) hydration tests in saturated water vapor at 240°C, a SA/V of ~ 10^6 cm^{-1}, and time periods up to 63 days. These results are compared to alteration observed in natural basaltic glasses of great age. 6 references, 6 figures, 1 table.

4965 **(CONF-841157—18) Rapid increases in permeability and porosity of bentonite-sand mixtures due to alteration by water vapor.** Couture, R.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02. File Number DE85001841.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Packed columns of canister packing material containing 25% bentonite and 75% quartz or basalt sand, were exposed to water vapor at temperatures up t 260°C. The permeabilities of the columns were subsequently measured after complete saturation with liquid water in a pressurized system. Exposure to water vapor caused irreversible increases in permeability by factors of up to 10^5. After saturation with liquid water, the permeability was nearly independent of temperature. The increases in permeability were due to a large decrease in the ability of the bentonite to swell in water. Calculations suggest that swelling of bentonite altered at 250°C was not sufficient to fill the pore spaces. If the pore spaces are filled, the mixture will form an effective barrier against flow, diffusion, and transport of colloids. The results suggest that if bentonite-based canister packing material is exposed even briefly to water vapor at high temperatures in a high-level nuclear waste repository, its performance will be seriously impaired. The problem is less severe if the proportion of bentonite is high and the material is highly compacted. Previous results show significant degradation of bentonite by water vapor at temperatures as low as 150°C. This suggests that in some repositories, backfill in tunnels and drifts may also be affected. 9 references, 5 figures, 1 table.

4966 **(CONF-841184—11) Upper critical fields in $RE_2Fe_3Si_5$ (RE = Y, Sc, Lu) compounds.** Umarji, A.M.; Malik, S.K.; Shenoy, G.K. (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003038.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

The $RE_2Fe_3Si_5$ compounds form with RE=Sm, Gd to Lu, Sc and Y and crystallize in the tetragonal $Sc_2Fe_3Si_5$ type structure. The compounds with RE=Lu, Y, and Sc are superconducting while those with RE=Gd to Er are antiferromagnetically ordered. We have carried out upper critical field (H/sub c2/) measurements on $Y_2Fe_3Si_5$, $Sc_2Fe_3Si_5$ and $Lu_2Fe_3Si_5$. The Lu compound, which has the zero field T/sub c/ of 6.0°K, has H/sub c2/(0) = 60 kOe, which is the highest for an iron-containing ternary compound. Results of critical field measurements have been analyzed in terms of WHH theory.

4967 **(CONF-841184—12) Magnetism and superconductivity in $Eu(Ho)Mo_6S_8$.** Capone, D.W. II; Lai Fook, M.S.; Guertin, R.P.; Hinks, D.G.; Dunlap, B.D.; Foner, S.; Abou-Aly, A.I.; Brooks, J.S. (Tufts Univ., Medford, MA (USA); Argonne National Lab., IL (USA); Massachusetts Inst. of Tech., Cambridge (USA); Boston Univ., MA (USA)). Oct 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003022.

From Magnetism and magnetic materials conference and exhibit; San Diego, CA, USA (27 Nov 1984).

A variety of ambient and high pressure experimental results reveal the interplay between magnetism and superconductivity in Ho doped samples of the pressure induced superconductor, $EuMo_6S_8$. Ho concentrations up to 50 atomic percent of the rare earth ions were used. High resolution magnetic measurements are consistent with the crystalline electric field ground state for the Ho^{3+} ions being a magnetic doublet consisting largely of J/sub z/ = 18. The results of high pressure magnetization experiments reveal negligible effects of reduced lattice constant on the rare earth-rare earth interactions. Resistivity in a 10 atomic percent sample for P = 10 kbar shows the suppression of a P = 0 structural transition, metallic conductivity down to low temperatures, and finally superconductivity at 8 K. The upper critical field, H/sub c2/(T), for this sample was measured for P = 7, 10 and 12 kbar and showed strong reentrant behavior (dH/sub c2/(T)/dT > 0 as T → 0 K). A minimum with field in the resistivity above H/sub c2/ was also observed at lowest temperatures. The H/sub c2/(T) data are compared with those of $EuMo_6S_8$ at high pressure, which shows positive curvature, and $HoMo_6S_8$, in which superconductivity is quenched by ferromagnetism at low temperatures. 14 references, 4 figures.

4968 **(ECN—149) Field-induced phase transitions in antiferromagnetic systems. An experimental study.** Smeets, J.P.M. (Netherlands Energy Research Foundation, Petten; Technische Hogeschool Eindhoven (Netherlands)). May 1984. 163p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85780202.

Neutron scattering experiments and magnetization measurements are carried out on cobalt bromide hexahydrate, of which 48% of the water molecules are replaced by deuterium oxide molecules. Results were compared with data obtained from non-deuter-

ated cobalt bromide hexahydrate. Neutron scattering experiments showed the importance of the deuterium fraction. Interplay exists between the crystallographic system and the magnetic system, which is influenced by changing the deuterium fraction. Neutron scattering and magnetization experiments on partially deuterated $RbFeCl_3.2H_2O$ and $CsFeCl_3.2H_2O$ were performed to study the magnetic phase transitions in these quasi one-dimensional Ising compounds. The observed behaviour in the various phases can be described by the nucleation theory of chain reversals.

4969 **(IA—1382) Measurement of the transport properties of (Sb2Te3)sub(0.75)(Bi2Te3)sub(0.25) solid solution with addition of Tl_2Te_3.** Sher, A. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center; Hebrew Univ., Jerusalem (Israel)). Mar 1983. 44p. (In Hebrew). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703393.

The thermoelectric parameters of the solid solution $(Sb_2Te_3)sub(0.75)(Bi_2Te_3)sub(0.25)$ in the presence of a low concentration of Tl_2Te_3 were examined. The electrical conductivity, thermal conductivity, Seebeck coefficient and Hall constant were measured on samples which represent the upper parts of the ingots, in the temperature range 10K-300K. The lattice thermal conductivity, carrier, mobility, effective mass and carrier concentration were calculated from the measured parameters. The variation of the carrier mobility with temperature was similar in all the measured samples. At temperatures higher than 80K the mobility was proportional to Tsup(-33/2). At lower temperatures the mobility approached a saturation value which decreased with increasing Tl_2Te_3 concentration. At about room temperature, the mobility was already not proportional to Tsup(x). Increasing the Tl_2Te_3 or Sb_2Se_3 concentration resulted in a lower deviation from the Tsup(x) dependence and a slower increase in the lattice thermal conductivity with decreasing temperature. Addition of Tl_2Te_3 to the solid solution resulted in minor improvement in the thermoelectric quality which depends on the mobility, effective mass and lattice thermal conductivity. The thermoelectric properties were nearly the same as those obtained by addition of Sb_2Se_3 to the solid solution. The addition of Tl_2Te_3 annulled an effect of increasing carrier concentration with decreasing temperature. It resulted in a slower decrease in the Seebeck coefficient.

4970 **(PNL-SA—12573) Time resolved Raman studies of laser induced damage in TiO_2 optical coatings.** Exarhos, G.J.; Morse, P.L. (Pacific Northwest Lab., Richland, WA (USA); Air Force Weapons Lab., Kirtland AFB, NM (USA)). Oct 1984. Contract AC06-76RL01830. 24p. (CONF-8410186—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003116.

From Symposium on optical materials for high power lasers; Boulder, CO, USA (15 Oct 1984).

Molecular information available from Raman scattering measurements of sputter deposited TiO_2 on silica substrates has been used to characterize crystalline phases, thickness, and surface homogeneity. A two laser technique is described for investigating transient molecular changes in both coating and substrate which result from pulsed 532 nm laser irradiation. Single layer and multilayer coatings of both anatase and rutile phases of TiO_2 have been probed by Raman spectroscopy immediately following the damage pulse (nanoseconds) and at longer times. Transient measurements are designed to follow surface transformation/relaxation phenomena; measurements at longer times characterize the equilibrium damage state.

4971 **(UCT-NLSMRU-TR—35) Nuclear radiation and the properties of concrete.** Kaplan, M.F. (Cape Town Univ. (South Africa). Nonlinear Structural Mechanics Research Unit). Aug 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703249.

Concrete is used for structures in which the concrete is exposed to nuclear radiation. Exposure to nuclear radiation may affect the properties of concrete. The report mentions the types of nuclear radiation while radiation damage in concrete is discussed. Attention is also given to the effects of neutron and gamma radiation on compressive and tensile strength of concrete. Finally radiation shielding, the attenuation of nuclear radiation and the value of concrete as a shielding material is discussed.

4972 **Localization and magnetism of an interstitial iron impurity in silicon.** Katayama-Yoshida, H.; Zunger, A. (Solar Energy Research Institute, Golden, Colorado 80401). *Physical Review Letters;* **53**: No. 13, 1256-1259(24 Sep 1984). Contract AC02-77CH00178.

The apparent dichotomy between the covalently delocalized nature of Si:Fe (as suggested by its reduced hyperfine field, its extended spin density, and the occurrence of two closely spaced stable charge states within 0.4 eV) and the atomically localized picture (suggested, among other reasons, by the stability of a high-spin ground-state configuration) is resolved through a self-consistent Green's-function calculation with the self-interaction—corrected local-spin-density formalism.

4973 **Algebraic decay of successive harmonics in a model two-dimensional system.** Mochrie, S.G.J.; Kortan, A.R.; Birgeneau, R.J.; Horn, P.M. (Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **53**: No. 10, 985-988(3 Sep 1984).

We report a high-resolution synchrotron x-ray scattering study of the weakly incommensurate stripe-domain phase of stage-4 bromine-intercalated graphite. We demonstrate power-law behavior at five harmonics (G) of the mass density wave, and confirm the scaling of the structure factor with G^2. Our results are consistent with recent theories of the two-dimensional uniaxial commensurate-incommensurate transition.

4974 **Super ionic conductive glass.** Susman, S.; Volin, K.J. (to Dept. of Energy). US Patent 4,465,744. 14 Aug 1984. Filed date 30 Nov 1982. vp.

PAT-APPL-445597.

An ionically conducting glass for use as a solid electrolyte in a power or secondary cell containing an alkali metal-containing anode and a cathode separated by an alkali metal ion conducting glass having an ionic transference number of unity and the general formula: A_1/sub +/ /SUB x/ D_2/sub -/ /SUB x/ /3Si /SUB x/ P_3/sub -/ /SUB x/ O_{12}/sub -/3 /SUB x/ /3, wherein A is a network modifier for the glass and is an alkali metal of the anode, D is an intermediate for the glass and is selected from the class consisting of Zr, Ti, Ge, Al, Sb, Be, and Zn and X is in the range of from 2.25 to 3.0. Of the alkali metals, Na and Li are preferred and of the intermediate, Zr, Ti and Ge are preferred.

4975 **Sodium diffusion and leaching of simulated nuclear waste glass.** McGrail, B.P.; Day, D.E.; Kumar, A. (Univ. of Missouri Rolla, Rolla, MO). *Journal of the American Ceramic Society;* **67**: No. 7, 463-467(Jul 1984).

Oxides such as CaO, ZnO, Fe_2O_3, and ZrO_2 were substituted for SiO_2 into a 14 Na_2O . 10 B_2O_3 . 76 SiO_2 (wt%) glass in proportion to their weight percent in PNL-7668 simulated nuclear waste glass. No correlation was found between the Na diffusion coefficient (D /SUB Na/) in the bulk glass and sodium leaching in water for any of the iron-containing borosilicate glasses. Effective diffusion coefficients calculated from the sodium leach rates in deionized water were 500 to 2000 times larger than D /SUB Na/ . The experimental leaching data agreed with a diffusion-convection model where the convective term was a measured "phase boundary" velocity moving into the glass.

4976 **Electron and positron channeling radiation type-Ia and Type-IIa diamonds.** Datz, S.; Fearick, R.W. (Oak Ridge National Lab., TN (USA)); Park, H.; Pantell, R.H.; Swent, R.L.; Kephart, J.O. (Stanford Univ., CA (USA)); Berman, B.L. (Lawrence Livermore National Lab., CA (USA)). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 77-79(Mar 1984). (CONF-830780—). Contract W-7405-ENG-26;W-7405-ENG-48.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Planar channeling radiation spectra have been obtained from type-Ia diamonds with 54.5 and 30.5 MeV electron and with 54.4 MeV positrons. Type-IIa diamonds are relatively free of impurities while Type-Ia diamonds contain 'platelet defects' [N atoms bonded

in the (100) plane]. For platelet free (type-IIa) diamond, theoretical calculations are found to fit experimental results quite well for electron channeling radiation. However, significant discrepancies (proportional 5%) exist between the theoretical predictions and the positron data. Measurements on a type-Ia diamond show large differences in the planar channeling radiation spectra which are anisotropic and which depend upon whether electrons or positrons are used as a probe.

4977 **Planar channeling radiation from relativistic positrons and electrons in LiF.** Berman, B.L. (Lawrence Livermore National Lab., CA (USA)); Datz, S.; Fearick, R.W. (Oak Ridge National Lab., TN (USA)); Swent, R.L.; Pantell, R.H.; Park, H.; Kephart, J.O.; KLein, R.K. (Stanford Univ., CA (USA). Dept. of Electrical Engineering). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 90-94(Mar 1984). (CONF-830780—). Contract W-7405-ENG-48;W-7405-ENG-26.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Channeling radiation has been measured for planar-channeled 54- and 83-MeV positrons and 17-, 31-, and 54-MeV electrons in the ionic crystal LiF. The results are shown to be in reasonable, but not perfect, agreement with the results of many-beam calculations based upon a model of the crystal as an array of isolated Li^+ and F^- ions.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 400100420I, 4325, 4351, 5276, 5364, 5365, 5366, 5367, 5368, 5369, 5370, 5385, 5386, 5387, 5388, 5463, 5586, 5602, 5602

4978 **(AEEW-R—1744) Review of analytical methods used at AEE Winfrith for determination of the isotopic purity of heavy water.** Brown, G.R. (UKAEA Atomic Energy Establishment, Winfrith). Feb 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703392.

This report outlines the development of methods for the determination of isotopic purity of heavy water at AEE Winfrith. Comparisons between methods based on infrared absorbance, refractive index, densitometry and mass spectrometry and details of procedures in current use are given.

4979 **(CSIR-K—62) Laboratory manual for the determination of inorganic chemical contaminants and nutrients in sewage sludges.** Smith, R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 1984. 46p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703240.

In addition to a brief discussion on sewage sludge disposal, sludge contaminants, and the potential beneficial and adverse effects of the various inorganic chemical contaminants and nutrients commonly present in sewage sludge, this technical guide presents a scheme of analysis for the determination of the major inorganic contaminants and nutrients. Safety and simplicity were the main criteria considered in the selection of the various sample pretreatment procedures and analytical techniques.

4980 **(CSIR-RR—394) Determination of trace metals. Evaluation of results.** Smith, R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 1981. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703241.

This study forms part of the NIWR's series of interlaboratory comparison studies involving southern African laboratories engaged in water and wastewater analysis, and is concerned with the analysis of synthetic water samples by 28 laboratories for cadmium, chromium, copper, iron, lead, manganese, zinc, arsenic, selenium and mercury. The results obtained are evaluated and discussed. With one exception, where inductively-coupled plasma optical emission spectroscopy was used, all the determinations were carried out by means of atomic absorption spectrophotometric methods. In general, the results compared favourably with those from similar overseas comparison studies.

4981 **(CSIR-RR—575) Determination of boron, silica, fluoride, MBAS, phenols, cyanide and sulphide. Evaluation of results.** Smith, R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703242.

This study forms part of the NIWR's series of interlaboratory comparison studies involving southern African laboratories engaged in water and wastewater analysis, and is concerned with the analysis of synthetic water samples by 31 laboratories for boron, silica, fluoride, methylene blue active substances (MBAS), phenols, cyanide and sulphide. The results obtained are evaluated and discussed. Recognised standard methods, or modifications of these methods, were used for most of the determinations. Results from the boron, silica and fluoride determinations showed, in general, acceptable accuracy and precision. Results from the MBAS, phenols, cyanide and sulphide determinations were, however, somewhat widespread, and illustrated the difficulty in obtaining reliable results from the measurement of relatively low levels of these determinands.

4982 **(CSIR-RR—602) Determination of trace metals in river sediment. Evaluation of results.** Smith, R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703243.

This study forms part of the NIWR's series of interlaboratory comparison studies involving southern African laboratories engaged in water and wastewater analysis, and is concerned with the analysis by 21 laboratories of a standard reference sample of river sediment for arsenic, cadmium, cobalt, copper, lead, manganese, mercury, nickel and zinc. The results obtained are evaluated and discussed, along with some of the advantages and disadvantages of various sample pretreatment techniques. The mean values of the results obtained for Cu, Hg, Pb, Ni and Zn were found to be in good agreement with the certified values for the standard reference sample, but those for Cd and Mn were considerably lower than the corresponding certified values. A fairly wide range of acid extraction or digestion procedures for pretreatment of the sample was used by the participating laboratories, most of whom employed direct flame atomic absorption spectrophotometry for the measurement of Cd, Co, Cu, Pb, Mn, Ni, and Zn. The few laboratories who determined As and Hg did so mainly by means of vapour generation/atomic absorption techniques.

4983 **(CSIR-RR—603) Analysis of a sewage sludge for inorganic chemical contaminants and nutrients. Evaluation of results.** Smith, R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Inst. for Water Research). 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703244.

This study forms part of the NIWR's series of interlaboratory comparison studies involving southern African laboratories engaged in water and wastewater analysis, and is concerned with the analysis by 29 laboratories of a sample of dried sewage sludge for various inorganic contaminants and nutrients by means of methods provided by the originating laboratory, the aim being to test these methods for their suitability for use in a proposed manual of methods for sewage sludge analysis. The results obtained are evaluated and discussed. From the results obtained, the suggested methods for the determination of pH, Kjeldahl, nitrogen, total phosphorus, calcium and magnesium, cadmium, chromium, copper, lead, nickel and zinc, mercury, and arsenic were considered to be sufficiently reliable for inclusion in the manual. It was recommended that further investigation be carried out on finding suitable methods for the determination of selenium, molybdenum, boron, and fluoride.

4984 **(DOE/ER/10465—T1) Development of surface immobilized ligands for actinide separations.** Paine, R.T. (New Mexico Univ., Albuquerque (USA)). 1982. Contract AC04-79ER10465. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002991.

The following are reported on: synthesis and characterization of new carbamylmethylenephosphonate (CMP) ligands suitable for actinide separations; synthesis, characterization, and structural properties of metal - CMP complexes; and design and characterization of immobilized CMP extractants. (DLC)

4985 **(DOE/ER/13181—T1) Hydrophobic character of nonsulfide mineral surfaces as influenced by double-bond reaction of adsorbed unsaturated collector species. Progress report.** Miller, J.D. (Utah Univ., Salt Lake City (USA). Dept. of Metallurgy). Oct 1984. Contract FG02-84ER13181. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002973.

One of the important collectors in the flotation of nonsulfide minerals is oleic acid. The solution chemistry of oleic acid and its influence on mineral flotation systems have been studied. However, the interaction of such adsorbed unsaturated carboxylates at the nonsulfide mineral surface and its impact on the hydrophobic character of the surface have not been studied. Temperature and oxygen can significantly increase the rate of flotation of nonsulfide minerals. Objective of this research program is to study the interaction of adsorbed unsaturated carboxylates at the surface of nonsulfide mineral systems. Experimental techniques are being used to measure hydrophobic character, adsorption density, surface spectra, and heats of interaction.

4986 **(EUR—8753) Certification of a uranium dioxide reference material for chemical analyses.** Le Duigou, Y. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). 1984. 51p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85780194.

This report, issued by the Central Bureau for Nuclear Measurements (CBNM), describes the characterization of a uranium dioxide reference material with accurately determined uranium mass fraction for chemical analyses. The preparation, conditioning, homogeneity tests and the analyses performed on this material are described in Annex 1. The evaluation of the individual impurity results, total of impurities and uranium mass fraction are given in Annex 2. Information on a direct determination of uranium by titration is given in Annex 3. The uranium mass fraction (881.34+-0.13) $g.kg^{-1}$ calculated in Annex 2 is given on the certificate.

4987 **(IAEA-RL—110) Report on intercomparison exercise SR-54. Determination of impurities in U_3O_8.** Doubek, N.; Bagliano, G.; Deron, S. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Apr 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703245.

The report presents results of a laboratory intercomparison of impurities in U_3O_8 sample organized by the IAEA's Analytical Quality Control Service. Twelve laboratories in 11 countries sent their results. The framework of the intercomparison was therefore conceived mainly as a "mean" to laboratories dealing with analysis of impurities in uranium samples to check the reliability of their results. The evaluation was based on 97 laboratory means obtained with emission spectroscopy, atomic absorption techniques and neutron activation analysis. The concentration of three elements could be certified as a result of this intercomparison; informational values could be established for an additional six elements.

4988 **(IAEA-RL—112) Report on intercomparison IAEA/soil-7 of the determination of trace elements in soil.** Pszonicki, L.; Hanna, A.N.; Suschny, O. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). May 1984. 145p. NTIS (US Sales Only), PC A07/MF A01. File Number DE84703239.

The report presents results of a laboratory intercomparison of the determination of concentration of trace elements in a sample of soil organized by IAEA's Analytical Quality Control Service. 56 laboratories in 25 countries returned results based on 999 laboratory mean values of 59 elements. The aim of this exercise was to enable the participating laboratories to check their analytical performance and to establish the concentration level of as many trace elements as possible for certification purposes. The analytical methods of activation analysis, atomic absorption, X-ray fluorescence and atomic emission were predominantly used for element determination. The number of outlying results was moderate (12%). The analytical results have enabled to certify the concentration of 28 trace elements in the soil material.

4989 **(IPEN-Pub—59) Spectrographic determination of niobium in uranium - niobium alloys.** Charbel, M.Y.; Lordello, A.R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jan 1984. 11p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780195.

A method for the spectrographic determination of niobium in uranium-niobium alloys in the concentration range 1-10% has been developed. The metallic sample is converted to oxide by calcination in a muffle furnace at 800°C for two hours. The standards are prepared synthetically by dry-mixing. One part of the sample or standard is added to nineteen parts of graphite powder and the mixture is excited in a DC arc. Hafnium has been used as internal standard. The precision of the method is + - 4.8%.

4990 **(KFKI—1984-55) Improved neutron capture technique for nitrogen determination in single maize seeds.** Feher, A.; Andras, L.; Csoeke, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780081.

Improvements to increase the sensitivity of nitrogen determination in single maize seeds were carried out using the capture gamma rays from the $^{14}N(n,gamma)^{15}N$ prompt reaction. By background and pile up reductions using geometrical, shielding and electronic considerations, a relative nitrogen determination error of 11% was achieved at a 95% confidence level for typical maize seeds (3 mg nitrogen, 200 mg mass) at 60 s measurement time, i.e. a relatively fast 1440 sample per day capacity could be reached in nondestructive seed selection for crude protein. At an analysis speed of 450 single seed/day simple automatic systems at the High Flux Reactor, Grenoble, France, were constructed and used to scan the crude protein distribution of single seed populations. 11 refs.

4991 **(KIYI—83-3) Automated system for study of protein content in cereals by nuclear method.** Annin, A.A.; Berezin, F.N.; Kisurin, V.A.; Melenevskij, A.Eh.; Nemets, O.F.; Ofengenden, R.G.; Patlan', Yu.V.; Tikhij, V.A.; Tkach, N.M.; Shidlyk, A.M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1983. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703391.

An automated system is described for nitrogen content and distribution analysis in single grain. This method uses nuclear reaction $^{14}N(d,p)^{15}N$ with deuteron energy 13.6 MeV. The system is based on computer SM-11 and CAMAC device. Structure and principal technical and program elements are considered. This system operates at fluxes of 10^4 s^{-1}, closed feedback with the automatic device for grain supply. It provides on line data processing and the following analysis of total results.

4992 **(ND-R—921(S)) Developments in physical techniques for nuclear materials science.** Ferguson, I.F. (ed.). (UKAEA Risley Nuclear Power Development Establishment). Sep 1983. 179p. (CONF-8209257—). HMSO, London, price Pound 6.00.

From 30. UKAEA diffraction analysis conference; Oxford, UK (28 Sep 1982).

A series of review papers is presented outlining and emphasising the role of 'diffraction analysis' in the United Kingdom Atomic Energy Authority. These cover: X-ray diffraction, transmission and scanning electron microscopy, electron microprobe analysis, secondary ion microscopy, neutrons, and the nuclear microprobe. Papers which balance these reviews describe contemporary work in diffraction and cover: small-angle neutron scattering (including in-situ studies of UO_2 at up to 1600°C) pulsed neutron sources, and recent applications of surface techniques in both the UK and France. The meeting included an after-dinner speech by Dr J Thewlis on the very early days of atomic energy, as well as a summary of the evolution of the Conference by I. F. Ferguson. Separate entries are made for five of the papers.

4993 (NIRS-M—38, pp 80-87) **New method of measurement of trace elements by using particle beams.** Matsumoto, Shinji (National Inst. of Radiological Sciences, Chiba (Japan)). 1982. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number TI85780072. (CONF-8012126—).

From 12. NIRS seminar on progress of isotope tracer techniques in biology and basic medicine; Anagawa, Chiba, Japan (4 Dec 1980).

A new method of measurement of light elements by using the particle beam from an accelerator was developed. This paper reports on the results of analyses of N-15 and O-18. The tandem accelerator of University of Tokyo was used to accelerate proton beam. The energy of protons was determined from the excitation curves of elastic scattering by N-15, O-18 and O-16. The scattering by O-16 was background count. Therefore, the measurement was made at the energy of small background and large true counting. Biological samples were examined. The linearity of counts with the concentration of N-15 and O-18 was confirmed. The cells which contain glycine (O-18, 71.8 percent) and methionine (N-15, 95 percent) were analyzed. The peaks of N-15 and O-18 were well separated from ten peaks by N-14 and O-16. The natural amounts of N-15 in adenine and O-18 in glucose were also measured. The resonance reaction method of measurement by using particle beam was developed.

4994 **(RAL—84-047) Status of the development of electron volt inelastic neutron spectroscopy.** Newport, R.J.; Taylor, A.D.; Williams, W.G. (Rutherford Appleton Lab., Chilton (UK)). May 1984. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700047.

High energy inelastic neutron scattering spectroscopy is reviewed in the light of material presented at the 'High Energy Excitations in Condensed Matter' (HEECM) Workshop, held at Los Alamos National Laboratory 13-15 February 1984. Particular attention is paid to the development of instrumentation based on nuclear resonance analysers.

4995 (ZfI-Mitt—80, pp 66) **Two new standards for the mass spectroscopic determination of the isotopic abundance of hydrogen, carbon, and oxygen in the range of natural abundance.** Herrmann, M.; Gerstenberger, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4996 (ZfI-Mitt—80, pp 68) **Application of the ultrasensitive mass spectroscopy to isotope analyses.** Dietze, H.J.; Becker, S. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4997 (ZfI-Mitt—80, pp 69) **Possibilities of the detection of superheavy elements by mass spectroscopic methods.** Becker, S.; Dietze, H.J. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4998 (ZfI-Mitt—80, pp 72) **New possibilities of the release of measuring gases for the mass spectroscopic isotope analysis of solids.** Mueller, G.; Hessel, D.; Zahn, H.; Muehle, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

4999 (ZfI-Mitt—80, pp 86) **Mass spectroscopic investigation of tin isotope variations in cassiterites of different geologic origin.** Hiller, H.; Haase, G.; Gerstenberger, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5000 (ZfI-Mitt—80, pp 134-135) **Mass spectrometric analysis of boron isotopes using $B(OCH_3)_3$.** Ustinov, V.I.; Ivanova, T.R.; Grinenko, V.A. (AN SSSR, Moscow. Inst. Geokhimii i Analiticheskoj Khimii). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5001 (ZfI-Mitt—80, pp 67) **Methods of chemical concentrating and identifying in exploring rare radionuclides in nature.** Bruchertseifer, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5002 **(ZfK—521) Development of destructive methods of burn-up determination and their application on WWER type nuclear fuels. Joint final report.** Hermann, A.; Stephan, H.; Nebel, D. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic); Radievyj Inst., Leningrad (USSR)). Mar 1984. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85700185.

Results are described of a cooperation between the Central Institute of Nuclear Research Rossendorf and the Radium Institute 'V.G. Chlopin' Leningrad in the field of destructive burn-up determination. Laboratory methods of burn-up determination using the classical monitors ^{137}Cs, ^{106}Ru, ^{148}Nd and isotopes of heavy metals (U, Pu) as well as the usefulness of ^{90}Sr, stable isotopes of Ru and Mo as monitors are dealt with. The analysis of the fuel components uranium (spectrophotometry, potentiometric titration, mass-spectrometric isotope dilution) and plutonium (spectrophotometry, coulometric titration, mass- and alpha-spectrometric isotope dilution) is fully described. Possibilities of increasing the reproducibility (automatic adjusting of measurement conditions) and the sensibility (ion impulse counting) of mass-spectrometric measurements are proposed and applied to a precise determination of Am and Cm isotopic composition. The methods have been used for burn-up analysis of spent WWER (especially WWER-440) fuel.

5003 **Quantitative X-ray microanalysis of uranium alloys with the analytical electron microscope.** Romig, A.D. Jr. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Microscopy (Oxford);* **135**: 191-202(Aug 1984).

X-ray microanalysis in the analytical electron microscope (AEM) is a powerful tool for studying elemental segregation on a

submicrometre scale. This technique has been applied to uranium and its alloys. Materials such as uranium are strong electron scatterers due to their high density and high atomic numbers. Hence, when performing AEM X-ray microanalysis on such materials special attention must be given to effects such as electron scattering and X-ray absorption. The objective of this paper is to describe the techniques which are required to perform quantitative X-ray microanalysis in these heavy metal alloys (U-Nb, U-Mo and U-Ti). Cliff-Lorimer k-factors determined experimentally and theoretically are in good agreement. Electron scattering has been studied experimentally and the results are compared to those obtained by Monte Carlo calculations and the single scattering model. X-ray spatial resolutions of better than 100 nm are attainable. With the proper selection of characteristic X-ray lines, X-ray absorption can be avoided in most cases to the limit of electron transparency, approx. 100 nm.

5004 **Adsorbate induced neutralization effects in low energy alkali and inert gas ion scattering.** Overbury, S.H.; Dekoven, B.M. (Oak Ridge National Lab., TN (USA)); Stair, P.C. (Northwestern Univ., Evanston, IL (USA)). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 384-390(Mar 1984). (CONF-830780—). Contract W-7405-ENG-26.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

The dissociative adsorption of oxygen on Mo(001) has been studied using low energy (500-1000 eV) Li^+, K^+ and He^+ ion scattering. Oxygen adsorption affects the energy and angular distributions of scattered ions, and also the intensity of scattered ion change in a manner which is dependent upon the type of ion used. The scattered ion intensities are examined as a function of oxygen exposure and compared for each type of ion for the same surface structure and under identical scattering geometry. The He^+ intensity drops very sharply with increasing oxygen exposure, decreasing by a factor of 10 with $<= 2$ L exposure for all azimuthal angles of incidence. The Li^+ intensity in all azimuths exhibits an initial decrease followed by a large increase and ultimately a decrease again as oxygen exposure increases. The K^+ intensity, while decreasing with exposure for incidence in the [100] azimuthal, is relatively unaffected by low oxygen exposure in the [110] azimuth. These contrasting dependencies are discussed and explained as manifestations of different neutralization mechanisms occuring in each case.

5005 **Direct liquid sample introduction for flow injection analysis and liquid chromatography with inductively coupled argon plasma spectrometric detection.** Lawrence, K.E.; Rice, G.W.; Fassel, V.A. (Ames Laboratory, IA). *Analytical Chemistry;* **56**: No. 2, 289-292(Feb 1984). Contract W-7405-ENG-82.

The coupling of flow injection analysis (FIA) or high-performance liquid chromatography (HPLC) techniques to inductively coupled plasma atomic emission spectrometry (ICP-AES) offers new and attractive approaches for the determination of elemental concentrations in a wide variety of sample matrices. One of the most attractive features that FIA offers is a rapid and precise means of automating sample introduction into an ICP for simultaneous, multielement analysis at the trace, minor, and major constituent level with minimal sample consumption. The utilization of the ICP as a detector for HPLC retains most of the advantages of FIA-ICP, while providing the analyst with a powerful and versatile means of compound separation. This added dimension becomes particularly important when metal speciation is of primary interest, rather than total metal content. To date, the coupling of FIA and HPLC to the ICP has only been accomplished using conventional cross-flow, concentric, or Babington-type pneumatic nebulizers. Limits of detection under these conditions have generally been observed to be poorer when compared to conventional continuous sample flow conditions. These limitations have been attributed to the large dead-volume and the sample losses associated with conventional nebulizers and band broadening of eluents from FIA transfer tubing or HPLC columns prior to entering the nebulizer unit. In an effort to resolve these difficulties, a microconcentric nebulizer has been developed which is inserted directly into the tip of a conventional sample introduction tube of an ICP torch. Preliminary data on the potential utility of direct liquid sample introduction into the ICP are presented. 12 references, 6 figures, 1 table.

5006 **Thermal-desorption gas chromatographic procedure for screening coal fly ash for volatile organic compounds.** Higgins, C.E.; Griest, W.H.; Caton, J.E.; Harmon, S.H. (Oak Ridge National Lab., TN). *Analytica Chimica Acta;* **154**: 173-180(1983). Contract W-7405-ENG-26.

Thermal desorption of coal fly ash in a flowing stream of helium liberates volatile compounds which are collected on Tenax resin. A chemical fingerprint of these components collected from the fly ash is obtained by using thermal desorption of the material collected on the Tenax resin and capillary-column gas chromatography. Compounds ranging in volatility from that of benzene (b.p. 80°C) through C_1-phenanthrene (b.p. ca. 360°C) are detected, but recoveries of components only through naphthalene (b.p. 218°C) are suitable for quantitative work. The method provides chemical information on volatile organic compounds complementary to that achieved by procedures based on solvent extraction. 14 references, 1 figure, 2 tables.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 4002004421, 5042, 5062, 5612

5007 **(DOE/ER/02026—43) Studies in chemical reactivity. Final report.** Carr, R.W. Jr. (Minnesota Univ., Minneapolis (USA). Dept. of Chemical Engineering and Materials Science). Oct 1984. Contract AC02-76ER02026. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002985.

A brief account is given of the research, which included studies of methylene reactions, hydroxyl radical reactions, and chlorofluoromethyl radical reactions with oxygen. (DLC)

5008 **(DOE/ER/02542—3) Dynamical studies of molecular systems. Progress report, February 1-October 18, 1984.** Rabitz, H. (Princeton Univ., NJ (USA). Dept. of Chemistry). 1984. Contract AC02-76ER02542. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003053.

Research was carried out in the general areas of collision dynamics and chemical kinetics. Research on the following topics was pursued: Average Wavefunction Method for Gas-Surface Scattering; Structural Analysis of Phase Space Trajectories; Sensitivity Analysis of Combustion Systems; Determining Equations for Derived Sensitivity Gradients and Densities; Sensitivity Analysis of Limit Cycles with Application to the Brusselator; and Parameter Space Mapping of First Order Ordinary Differential Equations.

5009 **(DOE/ER/13147—1) Perturbation and characterization of nonlinear processes. Progress report, November 15, 1983-November 14, 1984.** Swinney, H.L.; Swift, J. (Texas Univ., Austin (USA)). 14 Nov 1984. Contract AS05-84ER13147. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003028.

We have designed and assembled apparatus for the proposed research and have acquired a fairly powerful computer that is dedicated to this research program; these developments are described. A sequence of frequency locked states that we have recently observed in experiments on a nonequilibrium chemical reaction is described. Progress in quantification of nonlinear processes is reported.

5010 (DOE/METC—84-10, pp 186-209) **New ASPEN models for the free energy and density of solutions of aqueous electrolytes.** Dweck, J.S.; Blumenfeld, R.; Mendelson, M.A. (Jay S. Dweck, Consultant, Inc., Denver, CO). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

New physical property models for the calculation of the free energy and density of solutions of aqueous electrolytes have been developed for the ASPEN process simulator as part of the simulation of the Great Plains Coal Gasification Plant. The free energy

model is based on the local composition model which is used to calculate the enthalpy and component fugacities for solutions of aqueous electrolytes in ASPEN. The new model employs the local composition model for the calculation of the excess Gibbs free energy of the solution as a function of the concentration of the ionic species. Incorporation of this model allows for the calculation of liquid entropies, as well as free energies, for the solutions via the ASPEN process simulator. The new density model is an extension of the Debye-Huckel limiting law. The Debye-Huckel limiting law allows the prediction of the density of dilute solutions of dissolved salts by providing a relationship for the molar volume of the salt as a function of ionic strength. The relationship is linear in the square root of the ionic strength, with the slope dependent only upon the charges of the ions which constitute the salt. When combined with data for the infinite dilution molar volume of the salts, solution density can be calculated. The new model preserves the linear relationship with the square root of ionic strength, but introduces ion dependent parameters for the determination of the slope. The solution density is calculated in terms of the molar volumes of the individual ions, instead of salts, to maintain consistency with the true-component basis employed in ASPEN. Preliminary tests of the model have shown it to be far more accurate than the original limiting law, and applicable to more concentrated solutions (greater than 10 molar).

5011 (ND-R—921(S), pp 11-19) **Role of X-ray diffraction in the development of atomic energy.** Ferguson, I.F. (UKAEA Springfields Nuclear Power Development Labs.). Sep 1983. HMSO, London, England Pound 6.00. (CONF-8209257—).

From 30. UKAEA diffraction analysis conference; Oxford, UK (28 Sep 1982).

An analysis of the historical role of X-ray diffraction (XRD) in atomic energy is given. The use of XRD in studying irradiation damage, corrosion mechanisms and in distinguishing and differentiating chemically identical materials is discussed. An important feature of XRD in the UKAEA has been the introduction of new techniques to the country, as well as the development of new methods and equipment long before they had become available commercially. The many important and diverse roles of XRD in the UKAEA are described.

5012 (ND-R—921(S), pp 66-70) **Pulsed neutrons: the new way of doing neutron diffraction.** Willis, B.T.M. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics and Metallurgy Div.). Sep 1983. HMSO, London, England Pound 6.00. (CONF-8209257—-).

From 30. UKAEA diffraction analysis conference; Oxford, UK (28 Sep 1982).

The new Harwell electron linear accelerator HELIOS has been used for studying the crystal structures of powdered materials by neutron diffraction. Structural parameters can be determined as accurately with the pulsed method as with the more expensive and conventional method employing a high-flux nuclear reactor as source. The powder pattern can be indexed more easily with pulsed neutrons.

5013 (ZfI-Mitt—80, pp 12) **Theory of isotopic exchange equilibria in complicated systems.** Haberlandt, R.; Christoph, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5014 (ZfI-Mitt—80, pp 13) **Calculation and interpretation of natural isotope variations in aluminosilicates.** Christoph, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5015 (ZfI-Mitt—80, pp 15) **Relationship between anomalies in the relative abundance of ^{18}O, ^{17}O, ^{16}O and anomalies in the temperature dependence of isotopic fractionation factors.** Wolfsberg, M. (California Univ., Irvine (USA). Dept. of Chemistry). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5016 (ZfI-Mitt—80, pp 14) **Use of statistical mechanical perturbation theory for the calculation and interpretation of isotopic fractionation factors.** Wolfsberg, M. (California Univ., Irvine (USA). Dept. of Chemistry). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5017 (ZfI-Mitt—80, pp 17) **Intramolecular oxygen isotope geothermometry of hydrosilicates.** Schuetze, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5018 (ZfI-Mitt—80, pp 18) **^{18}O index - an isotope geochemical concept.** Schuetze, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5019 (ZfI-Mitt—80, pp 21) **Application of the modified cell theory to calculating the thermodynamic properties of dense isotopically substituted fluids.** Voertler, H.L.; Heybey, J. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5020 (ZfI-Mitt—80, pp 22) **Statistical mechanics' treatment of the differences in the adsorption behaviour of isotopic species.** Heybey, J.; Voertler, H.L. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5021 (ZfI-Mitt—80, pp 23) **Theoretical investigations of adsorption isotope effects of natural gas components under elevated pressure.** Heybey, J.; Harting, P. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5022 (ZfI-Mitt—80, pp 24) **Experimental investigations of special adsorption isotope effects under geologic conditions.** Harting, P.; Weingart, K.; Heybey, J. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

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5023 (ZfI-Mitt—80, pp 26-28) **Neodymium and strontium isotopes and their application to mineralizations.** Brandt, S.B.; Lepin, W.S.; Solodjankina, W.N.; Kolosnizyna, T.I. (AN SSSR, Irkutsk. Inst. Zemnoj Kory). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5024 (ZfI-Mitt—80, pp 30-31) **Isotopic study of boron in the process of formation of ore deposits.** Ustinov, V.I.; Grinenko, V.A.; Aleksandrov, S.M.; Ivanova, T.R. (AN SSSR, Moscow. Inst. Geokhimii i Analiticheskoj Khimii). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5025 (ZfI-Mitt—80, pp 42) **Investigations of the nitrogen isotope fractionation in the systems NH_4^+/NH_3 and N^{3-}/N_2.** Nitzsche, H.M.; Stiehl, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5026 (ZfI-Mitt—80, pp 46) **Investigations of the fractionation of sulfur isotopes in the chemical and biochemical oxidation of sulfides to sulfates.** Maass, I.; Wetzel, K.; Weise, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Heyer, J. (Akademie der Wissenschaften der DDR, Jena. Zentralinstitut fuer Mikrobiologie und Experimentelle Therapie). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5027 (ZfI-Mitt—80, pp 70-71) **Isotope analysis on nanomole gas samples.** Halas, S. (Uniwersytet Marii Curie-Sklodowskiej, Lublin (Poland). Inst. Fizyki). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5028 (ZfI-Mitt—80, pp 102-104) **Application of phase diagrams to represent the processes of isotope fractionation in the system water/ice/salt.** Brandt, S.S.; Brandt, S.B. (AN SSSR, Irkutsk. Inst. Zemnoj Kory). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5029 (ZfI-Mitt—80, pp 113) **Influence of pressure on the velocity of isotopic exchange reactions.** Harting, P.; Schroeter, U. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

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5030 (ZfI-Mitt—80, pp 128-129) **Fractionation of carbon isotopes by anaerobic decomposition of cellulose.** Ivanov, M.V.; Namsaraev, B.B.; Bondar', V.A.; Zyakun, A.M. (AN SSSR, Pushchino-na-Oke. Inst. Biokhimii i Fiziologii Mikroorganizmov). Nov 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5031 **CO_2-catalyzed surface area and porosity changes in high-surface-area CaO aggregates.** Berutu, D.; Barco, L.; Searcy, A.W. (Laboratorio di Chimica, Facolta di Ingegneria, Universita di Genova, Genoa). *Journal of the American Ceramic Society;* **67**: No. 7, 512-515(Jul 1984).

The changes in surface area and mesoporosity in aggregates of $\approx$0.01 μm cross-section CaO particles when heated in CO_2 at 686°C were determined from N_2 adsorption isotherms. Initially, the surface area decreases rapidly with little change in porosity. When the surface area has decreased below $\approx$90 m^2/g, surface area and porosity variations become consistent with expectations for coarsening by grain-boundary or bulk diffusion. The initial rapid decrease in surface area must result from CO_2-catalyzed surface diffusion, but the data suggest that surface diffusion is not rate-limiting. The ratelimiting step may be reaction of CO_2 to form surface $CO^{2-}{}_3$ ions or decomposition of these ions to O^{2-} ions and CO_2 gas.

5032 **Hydrolysis equilibria of tungsten(VI) in aqueous sodium chloride solutions to 300°C.** Wesolowski, D.; Drummond, S.E.; Mesmer, R.E.; Ohmoto, H. (Pennsylvania State Univ., University Park). *Inorganic Chemistry;* **23**: No. 8, 1120-1132(11 Apr 1984). Contract W-7405-ENG-26.

Formation constants for the protonated mononuclear and polynuclear forms of tungstate have been measured by means of a hydrogen electrode concentration cell from 95 to 290°C in 0.10-5.1 m NaCl solutions over a pH range of 2-8 and tungsten concentration from 5 X 10/sup -4/ to 10/sup -2/m. Polytungstates dominate the speciation in the 10/sup -2/ m solutions below a pH of 5, particularly in the low-temperature solutions. Monomers become increasingly stable at low tungsten concentrations, high temperatures, and high ionic strengths and are the only form of tungsten detected above 200°C at 5.1 m NaCl. The equilibrium quotients for the reaction WO_4/sup 2-/ + H/sup +/ ⟷ HWO_4/sup -/ have been determined to 300°C over the entire composition range. An analytical expression for the temperature and ionic strength dependence of these equilibrium quotients and derived thermodynamic properties are presented.

5033 **Densities and apparent molal volumes of aqueous manganese, cadmium, and zinc chlorides at 25°C.** Rard, J.A.; Miller, D.G. (University of California, Lawrence Livermore National Laboratory, Livermore, California). *Journal of Chemical and Engineering Data;* **29**: No. 2, 151-156(Apr 1984).

Densities of aqueous solutions of $MnCl_2$ have been measured from 0.04 to 6.03 mol kg^{-1}, of $CdCl_2$ from 0.25 to 6.36 mol kg^{-1}, and of $ZnCl_2$ from 0.04 to 7.32 mol kg^{-1}. These densities were measured at 25°C with very high purity chemicals by using 31-cm^3 single-stem pycnometers. For comparison, densities are also reported for low-purity $ZnCl_2$. Our experimental densities are compared to published literature data, and some discrepancies may be due to low-purity chemicals in certain other studies. Problems with hydro-

lytic precipitation of basic species from $ZnCl_2$ solutions above their equivalence pH values are discussed.

5034 **Hydrogenation of RhC_7H_8/sup +/ in the gas phase.** Jacobson, D.B.; Freiser, B.S. *Journal of the American Chemical Society;* **106**: No. 4, 1159-1160(22 Feb 1984). Contract AC02-80ER10689.

The bimolecular hydrogenation of RhC_7H_8/sup +/ in the gas phase, which is apparently stabilized by infrared radiation, is reported. Since directed hydrogenation of the C_7H_8 moiety is unlikely, a metal-mediated hydrogenation is proposed as the most likely reaction mechanism. Some information concerning the definition of the structure of the complex is included. Results of hydrogen/deuterium exchange reaction for the complex are included.

5035 **Catalytic distillation.** Smith, L.A.; Jones, E.M.; Wynegar, D.P. (Chemical Res & Licensing Co.). pp 8 of Proceedings of the American Inst. of Chemical Engr. 1984 Spring National Meeting. Vol. 34E. New York, NY, USA; A.I.C.H.E. (1984). (CONF-8405154—).

From American Institute of Chemical Engineers spring national meeting; Anaheim, CA, USA (20 May 1984).

"Catalytic Distillation" refers to a chemical process which performs both a catalyzed reaction and primary fractionation of the reaction components simultaneously. A structured catalyst which also is an effective distillation component has been patented by Chemical Research & Licensing Co., Houston, Texas, and developed in a joint venture with Neochem Corp., Houston, Texas, and the Department of Energy. The catalytic distillation packing has been commercially demonstrated successfully with nearly three years continuous service for an acid catalyzed reaction in a carbon steel distillation tower.

5036 **Fast ion transport in the NASICON analog $Na_3Sc_2(PO_4)_3$: structure and conductivity.** Susman, S.; Delbecq, C.J.; Brun, T.O.; Prince, E. (Argonne National Lab., IL). *Solid State Ionics;* **9-10**: 839-844(Dec 1983).

The room temperature modification of stoichiometric NASICON(Sc) is monoclinic Cc. At 64 °C there is a first order transition to a normal-conducting rhombohedral form R3c. Na(1) sites are fully occupied whereas Na(2) sites are partially occupied. At 167°C there is a transition to a superionic phase, but the structure remains rhombohedral R3c. Vacancies are now shared equally by Na(1) and Na(2) sites. Fast Na-ion motion in stoichiometric $Na_3Sc_2(PO_4)_3$ arises from vacancy motion in a dogleg path between Na(1) and Na(2) sites. 15 references, 6 figures, 3 tables.

5037 **Synthesis of metal phosphates using SiP_2O_7.** Bamberger, C.E.; Begun, G.M.; Heatherly, D.E. (Oak Ridge National Lab., TN). *Journal of the American Ceramic Society;* **66**: No. 11, 208-209(Nov 1983).

The reaction of SiP_2O_7 with rare-earth fluorides and oxides and with UO_2 proceeds at high temperatures (1000° to 1200°C) to convert the rare-earth and uranium compounds to ortho- or pyrophosphates. In these reactions between intimately mixed powders, very finely segregated SiO_2 is formed and distributed throughout the phosphates. This procedure may be useful for producing easily sinterable products, such as actinide-containing monoliths for nuclear waste disposal. 11 references, 1 figure, 1 table.

5038 **Kinetics and transport effects in the dehydration of crystalline potassium carbonate hydrate.** Stanish, M.A.; Perlmutter, D.D. (Univ. of Pennsylvania, Philadelphia). *AIChE (American Institute of Chemical Engineers) Journal;* **29**: No. 5, 806-812(Sep 1983).

The reaction kinetics and physical transport processes governing the thermal dehydration of solid $K_2CO_3.3/2H_2O$ particles were investigated. Isothermal reaction rate data were gathered using a thermogravimetric balance in which narrowly-sized $K_2CO_3.3/2H_2O$ crystals were dehydrated under a water vapor atmosphere at different pressures and temperatures. The magnitudes of the heat and mass transfer resistances external to and within the solid product were estimated from solutions off the relevant pseudosteady-state transport equations. In the temperature range 320 to 358 K, the vacuum dehydration of $K_2CO_3.3/2H_2O$ crystals smaller than 710 μm (-25 + 30 mesh) are accurately modeled by the spherical shrinking-core equation for the chemical rate control regime. In the presence of water vapor, external heat transfer to the particles was sufficient to prevent significant self-cooling; heat and mass transfer resistances within the particles were negligible. The activation energy for $K_2CO_3.3/2H_2O$ dehydration is approximately 91 kJ/mol in vacuum; the reaction becomes extremely slow at relative pressures (P/P/sub eq/) > 0.35. 23 references, 3 figures, 8 tables.

5039 **Thermodynamics of saturated aqueous solutions including mixtures of NaCl, KCl, and CsCl.** Conceicao P. de Lima, M.; Pitzer, K.S. (Univ. of California, Berkeley). *Journal of Solution Chemistry;* **12**: No. 3, 171-185(1983). Contract AC03-76SF00098.

The activity coefficients for saturated aqueous KCl, CsCl mixtures of NaCl with each of these electrolytes are calculated from solution properties using the ion interaction model as well as from the solubility. The agreement between the two sets of results for both single and mixed electrolytes is, in general, good when it is considered that the saturated solution molalities are often much higher than those whose properties were used in the evaluation of the ion interaction parameters. Also, for pure KCl (aq) the agreement is good up to 300°C, an extrapolation 50°C above the range of data on which the equations were based. 15 references, 5 figures, 3 tables.

5040 **Thermodynamics of saturated electrolyte mixtures of NaCl with Na_2SO_4 and with $MgCl_2$.** Conceicao P. de Lima, M.; Pitzer, K.S. (Univ. of California, Berkeley). *Journal of Solution Chemistry;* **12**: No. 3, 187-199(1983). Contract AC03-76SF00098.

The ion-interaction equation is used to calculate the mean activity coefficients for the saturated aqueous mixtures, NaCl + Na_2SO_4 and NaCl + $MgCl_2$. A comparison between these values with those obtained from solubility shows a good agreement over a wide temperature range as well as at high ionic strengths for both mixed systems. 22 references, 4 figures, 4 tables.

5041 **Thermodynamics of aqueous calcium chloride.** Phutela, R.C.; Pitzer, K.S. (Univ. of California, Berkeley). *Journal of Solution Chemistry;* **12**: No. 3, 201-207(1983). Contract AC03-76SF00098.

Various published measurements of the osmotic coefficient and the apparent molal enthalpy of aqueous $CaCl_2$ are examined and correlated. $CaCl_2$ shows an anomalous behavior near 5 molal. Below that molality the various properties are well represented by the usual ion-interaction equation with simple temperature dependent expressions for the second and third virial parameters. Information from neutron diffraction and crystal structure is considered in discussing the anomalous behavior at high molality. 18 references, 1 figure, 1 table.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 4003004299, 4299, 4425, 5013, 5016, 5030, 5034

5042 **(DOE/PC/50796—T7) Diffusion of gases in porous solids - simulation and measurements. Ninth quarterly report, July 16-October 15, 1984.** Evans, J.W. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). 1984. Contract FG22-82PC50796. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002860.

The progress report for the last (eighth) quarter contained an error analysis of experimental results previously obtained in the experimental phase of this project. It was concluded that the errors were excessive and efforts this quarter have been directed at rectifying this problem. The major source of error was the viscous flow contribution to mass transport through the porous plug wherein diffusivities are measured. Pressure differentials across the plug are maintained at their lowest possible value during diffusion experiments in order that transport of gases through the porous plug be by diffusion rather than by viscous flow. For a given pressure differential, viscous flow of the gas through the plug is proportional to the fourth power of the pore size while the diffusive transport is

unaffected by pore size in the ordinary diffusion regime. Prior experimental work had been carried out using a porous plug with a mean pore size of 29μm; this plug has been replaced with one of a 5μm mean pore size. Experimental data obtained this quarter on the diffusivity of methane and nitrogen are presented. Theoretical work concerned with Monte Carlo simulation of the diffusion of gases in porous solids has yielded interesting results. These are discussed briefly. 2 figures.

5043 (ZfI-Mitt—77, pp 21) **Syntheses of ^{15}N-amino acids.** Engelmann, H. (VEB Berlin-Chemie (German Democratic Republic)). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5044 (ZfI-Mitt—80, pp 96-98) **Isotopic composition of porphyrins and different structural groups of hydrocarbons in crude oil.** Bogacheva, M.P.; Kodina, L.A.; Galimov, Eh.M. (AN SSSR, Moscow. Inst. Geokhimii i Analiticheskoj Khimii). Nov 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5045 **Evolution of polaron states into bipolarons in polypyrrole.** Kaufman, J.H.; Colaneri, N.; Scott, J.C.; Street, G.B. (University of California Santa Barbara, Santa Barbara, California 93106). *Physical Review Letters;* **53**: No. 10, 1005-1008(3 Sep 1984).

The kinetics of polaron recombination into bipolarons in polypyrrole has been studied by optical-absorption spectroscopy on films doped in situ in an electrochemical cell. ESR studies confirm that the metastable states possess spin, while the stable states do not. The data reveal a slow evolution, consistent with polaron-diffusion rates limited by the mobility of the accompanying counterion.

5046 **Thermodynamics of alcohol-alcohol mixtures. 2. Prediction of vapor-liquid equilibrium data from heat of mixing data for alcohol-alcohol mixtures.** Pando, C.; Christensen, J.J.; Hanks, R.W.; Renuncio, J.A.R. (Department of Chemical Engineering and Contribution 293 from the Thermochemical Institute, Brigham Young University, Provo, Utah). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 73-79(Jun 1984).

An expression for the heat of mixing (h /SUP E/) of binary mixtures based on the assumption of the continuous linear association of both components is fitted to experimental h /SUP E/ data of alcohol-alcohol binary mixtures to determine the adjustable parameters. By use of these parameters, either isothermal or isobaric vapor-liquid equilibrium data are predicted following the method of Hanks, Gupta, and Christensen for 21 binary systems for which VLE and h /SUP E/ data have been found in the literature. The predictions obtained agree well with the experimental vapor-liquid equilibrium values even when the temperature difference between VLE and h /SUP E/ data is large.

5047 **Catalytic hydrodenitrogenation of quinoline in a trickle-bed reactor. Comparison with vapor phase reaction.** Satterfield, C.N.; Yang, S.H. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 11-19(Jun 1984).

Studies over a commercial $NiMo/Al_2O_3$ catalyst at 350, 375, and 390°C and 6.9 MPa using quinoline or various intermediate reaction products showed that the reaction rate constants for the various hydrodenitrogenation (HDN) reactions in the presence of an inert paraffin liquid are very similar to those for the same reactions in the vapor phase, although the liquid tends to equalize the adsorptivities of the various N-compounds present. Over a wide range, for a specified pressure and temperature, the percent conversion as a function of contact time is remarkably similar for liquid- and vapor-phase processing. In both cases, the overall HDN reaction is essentially zero order under the conditions studied. Equilibrium between quinoline and 1,2,3,4-tetrahydroquinoline is rapidly attained in both vapor-phase and liquid-phase processing. Homogeneous reactions were negligible except for the hydrogenation of quinoline to 1,2,3,4-tetrahydroquinoline.

5048 **Thermodynamics of alcohol-alcohol mixtures. 1. A continuous linear association model for alcohol-alcohol solutions.** Pando, C.; Christensen, J.J.; Hanks, R.W.; Renuncio, J.A.R. (Department of Chemical Engineering and Thermochemical Institute, Brigham Young University, Provo, Utah). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 67-72(Jan 1984).

An equation for the excess Gibbs energy of alcohol-alcohol solutions has been derived. The model used in the derivation is based on the hypothesis of a continuous linear association of both alcohol molecules. Expressions for the activity coefficients as well as for the heat of mixing are given. All these expressions contain three for the activity coefficients as well as for the heat of mixing are given. All these expressions contain three parameters which must be adjusted from experimental data; two of them have the physical significance of the equilibrium constants for the self-association process, while the third one is an interactionenergy parameter. The ability of the derived excess Gibbs energy equation to represent several sets of data is shown and the model is compared with other models widely used in the literature.

5049 **Physical and thermodynamic properties of dichlorosilane.** Cheng, J.S.; Dickens, L.L.; Hooper, J.R.; Hsu, G.; Lutwack, R.; Yaws, C.L. (Department of Chemical Engineering, Lamar University, Beaumont, Texas). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 48-52(Jan 1984).

Dichlorosilane has major use in the semiconductor industry for the epitaxial growth of high-grade silicon. It also is involved in a new process in the production of solar-cell grade silicon. Pertinent physical and thermodynamic properties, i.e., critical properties, vapor pressure, heat of vaporization, heat capacity, density, viscosity, surface tension, and thermal conductivity, are presented in concise graphical form with texts for rapid use.

5050 **Fischer-tropsch synthesis on a precipitated Mn/Fe catalyst in a well-mixed slurry reactor.** Satterfield, C.N.; Stenger, H.G. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 26-29(Jan 1984).

The olefin/paraffin ratio of the products at all carbon numbers was less than that with a reduced fused magnetite catalyst containing 0.4 to 0.8 wt % K_2O and the β-olefin/α-olefin ratio was much greater. Secondary hydrogenation and olefin isomerization reactions appear to be much more significant with the Mn/Fe catalyst. With both catalysts the Flory distribution was followed but in each case two values of the chain growth probability, α, were found, with a sharp increase above about C_{11}. Values of α based on the C_1-C_{10} products were less for the Mn/Fe catalyst than for the fused magnetite catalyst, attributed to the absence of potassium in the Mn/Fe catalyst. The activity of the present Mn/Fe catalyst was moderately less than that reported for a similar catalyst studied elsewhere in a bubble column.

5051 **Catalytic hydrodenitrogenation of quinoline in a trickle-bed reactor. Effect of hydrogen sulfide.** Yang, S.H.; Satterfield, C.N. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **23**: No. 1, 20-25(Jan 1984).

Studies at 350, 375, and 390°C and 6.9 MPa showed that the presence of H_2S (generated in situ from CS_2) in the overall reaction network somewhat inhibits hydrogenation and dehydrogenation reactions but markedly accelerates hydrogenolysis reactions, for a net increase in the overall rate of hydrodenitrogenation (HDN). These effects are similar to those observed previously in vapor-phase reac-

tions. H_2S has little effect on the activation energies for the hydrogenation and dehydrogenation reactions, but it significantly reduces those for the hydrogenolysis reactions. Certain plugging problems encountered upon reacting 5,6,7,8-tetrahydroquinoline are attributed to formation of a trimer imine as an intermediate. The presence of Tetralin in the liquid inhibits the overall hydrodenitrogenation reaction, indicating that inhibition by competitive adsorption is more important than the accelerating hydrogen-donor capability that Tetralin exhibits in some homogeneous reactions.

5052 **Ab initio molecular orbital calculations on clusters of methyl fluoride.** Ol, T.; Sekreta, E.; Ishida, T. (State Univ. of New York, Stony Brook). *Journal of Physical Chemistry;* 87: 2323-2329(1983). Contract AC02-80ER10612.

Various two-, and three-, and four-membered clusters of methyl fluoride have been studied by means of the Gaussian-70 program using the minimal STO-3G and the 4-31G basis sets. Results obtained by using the STO-3G set are more consistent with experimental results than those obtained by using the 4-31G set. The optimum C-F...H-C configuration in all clusters investigated is as follows: R/sub HF/ = 2.1 A, FHC angle = 180°, CFH angle = 120-125°. The optimum STO-3G stabilization energies obtained for the three cluster sizes correspond to the following: -0.78, -0.82, and -0.83, in kcal/mol of F...H-C interaction, for the two-, three-, and four-membered clusters, respectively; and -0.39, -0.82, and -0.83, in kcal/mol monomer, for the two-, three-, and four-membered systems, respectively. The optimum angles are in reasonable agreement with crystallographic data for solid methyl chloride. An explanation is given for the preferred angles of 120-125°.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 4004004409, 4420, 4772, 4773, 4774, 4775, 4776, 4777, 4778, 5032

5053 **Determination of internal cation mobilities in the molten system (Li-K)Cl at 723 K.** Takagi, R.; Jensen, K.J.; Shimotake, H. (Argonne National Laboratory, Chemical Engineering Division, Argonne, Illinois). *Journal of the Electrochemical Society;* 13: No. 6, 1280-1283(Jun 1984).

Internal cation mobilities of Li^+ and K^+ in the system (Li-K)Cl were determined experimentally using the counter current electromigration method over the temperature range 700-778 K, with initial equivalent fractions of KCl of 0.356, 0.416, and 0.451. The relative difference in internal cation mobilities of Li^+ and K^+ was found to reach as much as 7% in this range.

5054 **Electrochemical studies of lithium insertion reactions of vanadium oxide bronzes.** Raistrick, I.D.; Huggins, R.A. (Department of Materials Science and Engineering, Stanford University, Stanford, CA). *Proceedings - Electrochemical Society;* 84-1: 374-384(Oct 1983). (CONF-831086—).

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

The ambient temperature electrochemical insertion of lithium from organic solvent-based electrolytes, into a number of ternary and quaternary vanadium oxide bronzes has been investigated. Rapid lithium diffusion is found in the tunnel structure beta-phase materials Li /SUB y/ M /SUB x/ V_2O_5 (M = Na, K, Cu and Li) and in the layer structure bronze Li /SUB 1+y/ V_3O_8. Compositionally broad insertion phases are found in both types of system at lower lithium contents, but at higher concentrations narrow phases are found, possibly due to lithium ordering caused by strong electrostatic interactions. Large negative Gibbs free energies of insertion and rapid solid-state diffusion suggest consideration of these compounds as positive electrode materials in lithium cells.

4005 Photochemistry

5055 **Question of mode-specificity in unimolecular reaction dynamics.** Miller, W.H. (Univ. of California, Berkeley). *Laser Chemistry;* 2: 243-252(1983). Contract W-7405-ENG-48.

Unimolecular decomposition following state-specific laser excitation is considered. If the transition state for the unimolecular reaction possesses any geometrical symmetry, then it is shown that this can lead to mode-specificity in the decay rates (i.e., different states with essentially the same total energy and angular momentum react at significantly different rates). This is illustrated for a model problem of two coupled oscillators (the Henon-Heiles potential) and also for the unimolecular dissociation of formaldehyde, $H_2CO \rightarrow H_2 + CO$, which has a planar transition state. Dynamical calculations indicate that there may also be a significant degree of mode-specificity for the formaldehyde reaction beyond that due to symmetry. 11 references, 3 figures.

5056 **Molecular beam studies of primary photochemical processes.** Lee, Y.T. (Univ. of California, Berkeley). *Laser Chemistry;* 2: 219-227(1983). Contract AC03-76SF00098.

Examples will be given to illustrate how information concerning the energetics, dynamics and mechanism of dissociation processes can be obtained from the precise measurements of angular and velocity distributions of products in an experiment in which a well defined beam of molecules is crossed with a laser. 18 references.

5057 **Picosecond measurements of time-resolved geminate charge recombination.** Braun, C.L.; Scott, T.W. (Dartmouth Coll., Hanover, NH). *Journal of Physical Chemistry;* 87: No. 24, 4776-4778(1983). Contract AC02-83ER13102.

At 296 K, geminate cation-electron pairs in liquid hexane are found to recombine with an initial half-life of 9 ps or less. The first half-life increases to 70 +/- 20 ps at 214 K consistent with the known decrease in the drift mobility of electrons in hexamine. The results support the view that coulomb-field-driven diffusion of a localized electron and its parent cation determines the lifetime of the geminate charge pairs.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 4006004391

5058 **(JAERI-M—83-060) Radiation resistance of aromatic oils with improving pour point.** Arakawa, Kazuo; Hayakawa, Naohiro; Nakanishi, Hiroshi. (Japan Atomic Energy Research Inst., Tokyo). Apr 1983. 33p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703246.

Although poly(phenyl ethers) show great promise as high temperature radiation-resistant lubricants, their low temperature use is limited by the high pour point. To improve this, two kinds of poly(phenyl ethers) or isomers are mixed. The mixed oils are phenoxy-phenoxy diphenyl (mix-4P2E) which is a mixture of the structural isomers, alkyl diphenyl ether (mix-ADE) which is a mixture of mono- and di-alkyl diphenyl ethers, and poly(phenyl ether) (mix-PPE) which is a mixture of mix-4P2E and mono-alkyl diphenyl ether. The commercial base oils used for comparison are two types of mineral oils and synthetic aromatic oils. Each oil was irradiated with γ-rays at a dose rate of 1×10^6 rad/h under vacuum, in air, and in the condition that the oil was bubbled by oxygen. Specific gravity, viscosity, total acid number, flash point and color were measured after irradiation. The most radiation resistant one was mix-4P2E, and mix-PPE with improved viscosity-temperature properties and pour point showed excellent stability to radiation.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 4007005037, 5221, 5223, 5451, 5968, 5969

5059 **(DOE/ER/02190—4) Dynamics and mechanisms of catalytic processes and hot chemistry. Final report, March 1, 1972-October 31, 1984.** Spicer, L.D. (Utah Univ., Salt Lake City (USA)). Oct 1984. Contract AC02-76ER02190. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002899.

General areas of research addressed are recoil chemistry of halogens, tritium, and sulfur, radiotracer methods for studies of

chemical dynamics, thermal and photochemistry of sulfur dioxide, and photochemistry and photoassistance in catalytic systems.

5060 **(DOE/ER/60176—1) Radiochemical studies using a 42 MeV cyclotron. Progress report, September 1, 1983-September 30, 1984.** Tilbury, R.S. (Texas Univ., Houston (USA). System Cancer Center). 1984. Contract AS05-83ER60176. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003027.

Progress is reported in the following areas: (1) new methods of producing ^{18}F and ^{18}F-labelled compounds; (2) recirculating aqueous system for making ^{13}N and ^{11}C labelled compounds; (3) production of $^{131}Ba/^{131}Cs$ for use in radiotherapy implants; and (4) preparation of ^{11}C labelled pyruvic acid for use in assessment of hypoxia in tumors. (ACR)

5061 **(IPEN-Pub—58) Preparation of glucoheptonate - sup(99m) Tc using stannous ascorbate as reducing agent for TcO^-b ion.** Barboza, M.R.F.F. de; Silva, C.P.G. da. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Dec 1983. 13p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85780196.

A preparation procedure of stannous ascorbate in lyophilized form is presented. This reducing agent was employed for the preparation of kits of calcium glucoheptonate (GHA) to be labelled with sup(99m) Tc for use in kidney scintigraphy. Comparative studies between kits prepared with stannous ascorbate and those prepared with stannous chloride as reducing agent were made. The labelling yield during 18 hours after the addition of sup(99m) TcO^-_4 was higher when stannous ascorbate was used. The stability of kits of calcium glucoheptonate - sup(99m) Tc containing stannous ascorbate was studied during five months after its preparation in the lyophilized form. On the fifth month the labelling yield of GHA - sup(99m) Tc was 89-95%, being therefore suitable for kidney scintigraphy.

5062 (KAERI/RR—329/81, pp 97-132) **Dissolution study of cobalt oxide by hydrogen peroxide in boric acid solution.** Yang, K.R.; Lee, I.C.; Suk, T.W. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. (In Korean). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780089.

In Water chemistry of PWR power plant.

A dissolution study of CoO (cobaltous oxide) by hydrogen peroxide was carried out in boric acid solution at 60degC. The chemical species of dissolved cobalt are Co^+_2 and $Co(OH)^+$, being equilibrated with $Co(OH)_3$, and the concentration ratio of both ion species is determined by pH of the solution. Hydrogen peroxide accelerates the dissolution of CoO, which occurs during its decomposition. In the case where the solution is oxygenated, $Co(OH)_3$ in the solution and/or covering the CoO crystal surface as a layer becomes Co_2O_3 remarkably less soluble than CoO and the reaction rate becomes somewhat slow with decreasing pH. On the basis of the results, it could be concluded that, in order to decrease the radiation dose rate on the personnel and the ^{58}Co inventory in primary coolant system at the minimum in the practical use, the ^{58}Co removal procedures must consist of: 1) The first step in that addition of small amount of hydrogen peroxide and oxygen removal are conservitively performed several times for accelerating the dissolution of ^{58}Co 2) The second step in that only addition of relatively larger amount of hydrogen peroxide is performed for repressing the dissolution of ^{58}Co.

5063 (KEK—82-8, pp 19-29) **Production of Ho-163 by the reaction of Dy-164(p,2n)H-163.** Fujioka, Manabu; Ishii, Keizo; Shinozuka, Tsutomu (Tohoku Univ., Sendai (Japan)) (and others). Sep 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

The production of the intense sources of Ho-163 was made to use for the study of neutrino mass. The Ho-163 isotope was produced by the reaction Dy-164 (p, 2n) Ho-163 using the proton beam of the cyclotron at Tohoku University. A metal sample of Dy-164 enriched to 98.43 % was used as a target, and was irradiated in a vacuum chamber. The following techniques in the Ho-163 production are described in details; (1) the preparation of the Dy-164 metal target from a $(Dy\text{-}164)_2O_3$ sample, (2) the setting of the Dy-164 target to the cooling block and its removal, (3) the safety inter-lock in the cooling system, (4) the thermal design for the cooling block-target system, and so on. A maximum amount of Ho-163 obtained by the four test irradiations on different conditions was estimated to be about 5 micro-grams. The estimation of the Ho-163 yield was made by comparing the theoretical calculation with the PIXE measurement. The details on the estimation of the heat conduction in the cooling system are also given in Appendix.

5064 (KEK—82-8, pp 30-39) **Chemical separation of Ho-163 and source preparation.** Omori, Takashi; Izawa, Gunzo (Tohoku Univ., Sendai (Japan). Faculty of Science); Yagi, Masuo; Masumoto, Kazuyoshi; Fujioka, Manabu. Sep 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

A radiochemical procedure is presented for the separation of Ho-163 from a Dy-164 metal target and for the preparation of a Ho-163 source. Since this source is used for the measurement of electron neutrino mass, many difficult procedures are required; the separation of Ho-163 from the Dy-164 target irradiated with proton beam, the use of a tracer of other element for observing the separation behavior, the removal of the traces of radioisotopes produced in the target, the preparation of a thin point source, and so on. The separation procedure consists of the dissolution of the irradiated Dy-164 metal with ammonium hydroxide, the separation of Ho-163 by a cation exchange column, the concentration of Ho-163 and the purification. The dissolution curves were obtained from the total gamma activity, and the identification of nuclides was made by the use of a Ge(Li) detector and LEPS. The preparation of the Ho-163 source was performed by an electrodeposition method. The details on every step of these procedures are described.

5065 **Metallography of highly radioactive materials.** Crouse, R.S. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 28-29 of Shaping our energy future. Knoxville, TN, USA; LTM Consultants (1984). (CONF-840229—).

From 11. annual WATTec conference and exposition - shaping our energy future; Knoxville, TN, USA (21 Feb 1984).

Abstract only.

Over the years metallographic facilities and techniques have been developed to very successfully do all of the analyses that might be required of all radioactive materials. This paper describes the facilities for remote metallography at the Oak Ridge National Laboratory, explains the philosophy of operation, development of equipment, and modification of techniques. Examples of microstructures, both common and unique, are presented. Electron beam microanalysis of radioactive materials is discussed also.

5066 **Am(III) hydrolysis constants and solubility of Am(III) hydroxide.** Rai, D.; Strickert, R.G.; Moore, D.A.; Ryan, J.L. (Pacific Northwest Lab., Richland, WA). *Radiochimica Acta;* **33**: 201-206(1983). Contract AC06-76RL01830.

Americium(III) hydroxide solubility was measured in dilute salt solutions under an argon atmosphere. The equilibrium, attained in < 23 days, was approached from both over and undersaturation. Thermodynamic equilibrium constants (K/sub S10/°) for the solubility of $Am(OH)_3$ (amorphous) [$Am(OH)_3$ (amorphous) + 3 $H^+ \rightleftharpoons Am^{3+}$ + 3 $H_2O \rightleftharpoons$ Am(OH)/sub n//sup 3-n/ + nH^+] were calculated from the solubility data. The measured value of log K/sub S10/° was 17.5 +/- 0.3. The values of log β_1°, log β_2°, and log β_3° were ≦ -8.2, -17.1 +/- 0.5, and ≦ -27.0, respectively. Contrary to predictions in the literature, Am(III) does not show amphoteric behavior in the pH range studied [i.e., no evidence for the existance of $Am(OH)_4^-$ species]. 18 references, 2 figures, 5 tables.

5067 **Hydrolysis and carbonate complexation of dioxoneptunium(V) in 1.0 M $NaClO_4$ at 25°C.** Maya, L. (Oak Ridge National Lab., TN). *Inorganic Chemistry;* **22**: 2093-2095(1983). Contract W-7405-ENG-26.

The purpose of experiment was to obtain data on the hydrolysis and carbonate complexation of NpO_2^+ which might then be

used to establish speciation schemes of this ion under conditions similar to those found in nature. Chosen experimental approach was based on determination of Np solubility of a well-defined solid phase as a function of carbonate concentration in a medium of constant ionic strength. The carbonate complexation constants and the hydrolytic constants measured were used to calculate a species distribution scheme for Np(V) in the pH range 7-9 under a partial CO_2 pressure if 10^{-3} atm. Analysis of data shows that the dominant species to be found in nature would be $NpO_2CO_3^-$ and/or $NpO_2(CO_3)_2^{3-}$. Formation of $NpO_2(CO_3)^{3-}$ would require an unusually high degree of oversaturation by the common carbonate minerals. Np(V) shows a tendency to form relatively stable carbonate complexes, leading to the prediction that it would be found in groundwaters in the form of a complex. 18 references, 2 figures, 1 table.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

5068 **(PB—84-232487) Determination of the thermal decomposition properties of 20 selected hazardous organic compounds. Research report.** Dellinger, B.; Torres, J.L.; Rubey, W.A.; Hall, D.L.; Graham, J.L. (Dayton Univ., OH (USA). Research Inst.). Aug 1984. 204p. NTIS, PC A10/MF A01.

Laboratory determined thermal decomposition profiles and kinetic data for a list of 20 selected hazardous organic compounds are reported. All data were obtained in flowing air at mean gas-phase, high-temperature zone residence times ranging from one to six seconds. The extrapolated temperatures required for 99.99% destruction of the parent compound at two seconds mean residence time, T(99.99)(2), ranged from 600C for 1,1,1-trichloroethane to 950C for acetonitrile. The process and parameters potentially controlling incineration efficiency are discussed, and four previously proposed methods of ranking compound incinerability are critically reviewed.

5069 **Mass spectrometric study of the high temperature chemistry of benzene.** Smith, R.D.; Johnson, A.L. (Pacific Northwest Lab., Richland, WA). *Combustion and Flame;* **51**: 1-22(1983).

The high temperature pyrolysis of benzene was studied by monitoring the gas phase species flowing from a Knudsen reaction cell using modulated molecular beam mass spectrometry. The pyrolysis was studied at temperatures up to 1900°C and pressures to 5 Torr. At low pressures hydrogen and carbonaceous deposits (soot) on the reaction cell wall were the dominant products. The disappearance of benzene at the low pressure limit was found to have an apparent activation energy of 82 +/- 5 kcal/mole. The rate of carbon formation was determined indirectly from the difference between carbon from benzene flow into the reactor and products leaving the reactor, and good agreement was noted for carbon recovered from the reactor for extended experiments at 1600°C. Carbon deposition is most efficient at low pressures; carbon deposition increases with pressure but the fraction of deposited carbon decreases as gas phase reactions become important. At higher pressures, where gas phase reactions dominate, C_2H_2, C_4H_2, C_6H_2, C_6H_6, $C_{12}H_{10}$, $C_{12}H_8$, H_2, and carbon were the major products. The results suggest that the pyrolysis of benzene primarily involves the reaction of an excited benzene molecule to form a $C_{12}H_{12}$ intermediate which decomposes to yield $C_{12}H_{10}$ and other products. Isotopic exchange in C_6H_6-D_2 and C_6H_6-C_6D_6 mixtures occurs at the same temperature as bimolecular reaction. At temperatures greater than 1100°C more direct processes involving C_6H_4 appear to contribute. The pyrolysis occurs primarily by molecular processes, possibly due to the effects of wall-related reactions. 41 references, 16 figures, 2 tables.

5070 **Symposium (international) on combustion.** Pittsburgh, PA, USA; Combustion Institute (1982). 1598p. (CONF-820801—).

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

Topics discussed are related to elementary reactions, reaction mechanisms and modeling, laminar flames, flame chemistry, turbulent reacting shear flows, turbulent premixed flames, turbulent combustion measurements, continuous combustors, detonation, detonation and explosion, heterogeneous detonation, propellant combustion, fire-ignition and thermal degradation, fire-flame spread and burning, fire-modeling, spray combustion, and droplet combustion. Coal combustion kinetics and mechanisms are considered along with coal combustion mechanisms and pyrolysis, coal combustion techniques, NOx in coal combustion, gaseous pollutants, soot and PAH, soot and inorganic pollutants, I.C. engine combustion, and ignition and extinction. Attention is given to intricate paths and simple steps in chemical kinetics and combustion, the formation of polycyclic aromatic hydrocarbons by combustion, turbulent flame structure and speed in spark ignition engines, and unresolved problems in SOx, NOx, and soot control in combustion.

5071 **C1 and C2 chemistry in rich mixture, ethylene/air flames.** Levy, J.M.; Taylor, B.R.; Longwell, J.P.; Sarofim, A.F. (MIT, Cambridge, MA). pp 167-177 of Symposium (international) on combustion. Pittsburgh, PA, USA; Combustion Institute (1982). (CONF-820801—).

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

Decay profiles of methane, acetylene, and hydrogen atoms are modeled in the post flame zone of four fuel-rich, atmospheric pressure ethylene/air flat flames, at fuel equivalence ratios of 1.71 to 1.83 and adiabatic flame temperatures of 1992 to 2126 K. Chain branching is required in the fuel-rich hydrocarbon combustion mechanism for the simulation of hydrogen atom measurements. The mechanism of hydrocarbon suppression of free radical overshoot is discussed. 52 references.

5072 **Mixed-convective flame structure in the stagnation point of a fuel particle.** Fernandez-Pello, A.C.; Law, G.K. (California Univ., Berkeley). pp 1037-1044 of Symposium (international) on combustion. Pittsburgh, PA, USA; Combustion Institute (1982).

An analysis is developed for the mixed, forced and free, convective gasification, ignition, steady burning and extinction at the stagnation point of a condensed fuel particle. The analysis makes use of the boundary layer approximation to describe the gas flow of the flame-sheet approximation to analyze the fuel burning process, and of large activation energy asymptotics to study the ignition and extinction phenomena. A mixed-convection parameter is introduced in the formulation of the problem in such a way that the forced or free conditions are respectively recovered for zero value of the Grashof or Reynolds number. This unified formulation of the problem permits the derivation of general criteria for ignition and extinction, and the description of the gasification and burning processes when the fuel particle is subjected to convective flows of different nature and intensity. Explicit expressions are derived for the gasification and mass burning rates and for the critical Damkoehler numbers for ignition and extinction. 18 references.

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4201 General Engineering

5073 **(Juel-Spez—255, pp 157) Engineering office and mechanical workshop.** Briell, W.; Gross, D.; Hadamek, H.; Retz, A.; Rindfleisch, U.; Schwan, H. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5074 **(SRD-R—245) Noncoherent structure theory: a review and its role in fault tree analysis.** Johnston, B.D.; Matthews, R.H. (UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate). Oct 1983. 93p. UKAEA-Safety and Reliability Directorate, Culcheth, Warrington, WA3 4NE, England £ 5.00. File Number TI85900243.

This report presents a review of the mathematical theory of noncoherent structures in which the mathematical implications of analyzing structure functions involving NOT logic are considered in detail. The report then discusses the application of Noncoherent Structure Theory to practical fault tree analysis; it investigates the

need for and usefulness of NOT logic in fault trees. A new perspective on the use of NOT logic is given. A new method is proposed where the minimal cut sets are obtained via the prime implicants. This gives rise to definitions of coherent approximation, island of success and spurious system failure modes. To prevent occurrence of the latter, the new concept of stochastic phase changes is introduced.

5075 **(UCID—30200-83-4) Console I/O routines.** Comfort, W.J. III. (Lawrence Livermore National Lab., CA (USA)). 7 Sep 1984. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002644.

These console input-output routines are designed to provide the μCAE programmer with standard formats for microcomputer prompts, queries, and cues in the framework of user-friendly interaction. To that end, error checking and recovery have been implemented wherever possible to lessen the chance of the user inadvertently introducing a catastrophic failure. The routines are written in Microsoft Basic (MBasic) and are intended to operate in a CP/M environment; modification will be required for other operating systems. Our objective with these routines is to standardize the methods and presentation of user-computer interaction so that the user experiences a uniform and comfortable approach to μCAE programs. Additionally, we hope to encourage uniformity in programming without constraining individual programming styles.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 4202004216, 4226, 4227, 4230, 4238, 4239, 4241, 4242, 4244, 4245, 4250, 4252, 4313, 4340, 4341, 4342, 4343, 4352, 4353, 4400, 4615, 4653, 4883, 4885, 4925, 5279, 6081

5076 **(ENEA-RT/ING—82-26) Hot cell facilities and post irradiation programs.** Cesarano, C.; Marsico, B.; Trezza, G. (ENEA, Rome (Italy)). 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780208.

The first facility for post-irradiation analysis in Italy was built in 1961 and has been operated since 1962. The basic design of the facility was based upon the requirements of the irradiation programs of that time, however it incorporated sufficient flexibility to accomodate future foreseeble expansion of the programs. The facility include three hot cells with five working stations. The hot cells could receive specimens of fuel in the range of about 2000 Curies (1 MeV) and with length below 1 meter. The post irradiation techniques developed in the laboratory included non destructive tests and more detailed analyses on small samples obtained (upon dismantling) from the fuel specimens. The hot laboratory has operated quite satisfactorily for many years, however the evergrowing requirements of the post irradiation programs, namely the requirements associated with the development of fuel elements for fast reactor, could not be met with the available hot cells. It appeared the need for a new facility where fuel containining Plutonium with length in the range of 1.5 - 2.5 meter and with activity of about 100000 Curies (1 MeV) could be analysed providing the highest standard of protection.

5077 **(HEDL-SA—2947-FP) Development of an automated miniature Charpy test method.** Hu, W.L. (Hanford Engineering Development Lab., Richland, WA (USA)). Aug 1983. Contract AC06-76FF02170. 20p. (CONF-8309170—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003011.

From Symposium on the use of nonstandard subsized specimens for irradiated testing; Albuquerque, NM, USA (23 Sep 1983).

A miniature instrumented Charpy impact test device was developed and automated for testing irradiated specimens. The DBTT for various types of Charpy specimens made of ferritic alloys were determined. The upper shelf energy for each type of Charpy specimen could be normalized by a generalized term of the state of stress at the notch root.

5078 **(NP—5770003) Investigation of the sound propagation depending on the form, cross-section and the support of the roadway.** Langebrake. (Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.)). 26 Jul 1982. 11p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770003.

It is reported about sound level measurements in mines with cross-sections of up to 40 m^2. The roadway cross-section was found to present the main influence parameter of the increase of the sound level. It was found that for estimating of the increase of the sound level of a machine a spectral evaluation is necessary. The increase of the total sound level has to be calculated from the increase of the dominating frequency parts of the machine noise.

5079 **(SAND—84-2208C) Ideas to hardware at SNLA.** Plomp, P.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 6p. (CONF-8411112—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000415.

From IMOG CAD/CAM factory management seminar; Miamisburg, OH, USA (8 Nov 1984).

Sandia's Processes Engineering and Fabrication (P/F) Directorate 7400 is a direct support organization providing shop services for the weapon and nonweapon programs. The directorate is divided into two departments, which are in turn subdivided into divisions. These divisions are comprised of functional groups which are generally supervised by a craft trained employee, whose title is a section supervisor. The functional groups are called sections and are responsible for unique craft services. The interaction with the customer (technical aides, engineers, and scientists) occurs at the section level. Cost and delivery estimates are provided at that level, and after receipt of a Work Order, the section makes all the arrangements to complete the requested services. A centralized production control function using sophisticated software is not used, rather, control is maintained by each functional group. This paper provides a sampling of the prototype hardware that has recently been manufactured by the P/F Directorate, gives a snapshot of the organization, describes the methods for controlling the flow-of-work, and shows a small sample of the specialized equipment found within the P/F Directorate.

5080 **(SRD-R—291) Effect of wall thickness on the behavior of aluminium and steel road tankers carrying flammable liquids when they are engulfed in flames.** Clifton, J.J. (UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate). Apr 1984. 18p. UKAEA, Safety and Reliability Directorate Culcheth Warrington, WA3 4NE, England. File Number TI85900246.

Computer calculations have been carried out for the range of volumes and minimum wall thicknesses of non-pressure tanks of road tankers carrying flammable liquids when engulfed in fire. These calculations show that the consequences of fire engulfment are relatively insensitive to the tank wall thickness over the range of thicknesses used. 6 references, 7 figures, 3 tables.

4203 Lasers

REFER ALSO TO CITATION(S) 4203004335

5081 **(AD-A—142789/7) Characteristics of a plasma-injection-controlled discharge for CO_2 mixing lasers.** McLeary, R.; Beckwith, P.J. (Materials Research Labs., Maribyrnong (Australia)). Apr 1984. 24p. (MRL-R—922). NTIS, PC A02/MF A01.

This report presents the characteristics of continuous electric discharges which have been used in high-power carbon-dioxide mixing lasers. The discharges in nitrogen at atmospheric pressure are stabilized by the plasma-injection technique. Discharge characteristics are presented for a range of discharge dimensions, pre-ionizing discharge currents and gas-flow rates. Specific input energies as high as 900 kJ/kg have been achieved.

5082 **(AD-A—142797/0) Nd(3+) beta'' alumina platelet laser. Technical report.** Jansen, M.; Alfrey, A.; Stafsudd, O.M.; Dunn, B.; Yang, D.L. (California Univ., Los Angeles (USA). Dept. of Materials Science and Engineering). May 1984. 19p. (TR—2). NTIS, PC A02/MF A01.

Prepared in cooperation with Pennsylvania Univ., Philadelphia, Dept. of Materials Science.

Pulsed as well as cw laser action has been observed in a new host material for Nd^{3+} ions, Na^{+} beta alumina. The unusual characteristics of the material and its known physical properties are briefly described. Absorption spectra, fluorescence lifetime, laser-pulse shape, and peak emission wavelength are presented as experimental evidence, and comparisons are made with other Nd^{3+} host materials. Some exciting new possibilities for integrated-optics applications are explored.

5083 (AD-A—142966/1) Time-dependent oscillations in a cw HF chemical laser unstable resonator. Master's thesis. Towsend, S.W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1984. 69p. NTIS, PC A04/MF A01.

The multi-line performance of a cw HF chemical laser was measured as a function of the SF_6 and H_2 flow rates, pressure and resonator type. The Blase II and MNORO3 cw chemical laser computer codes gave reasonable agreement with the experimental data as the flow rates and pressure were varied. Total power and beam diameter increased as the pressure decreased. The data indicate the occurrence of a near-resonant energy transfer from v=2, J=3, 4 to v=2, J=14 with a subsequent rotational cascade to v=2, J=11. The amplitude, frequency, and Fresnel number dependence of the time-dependent oscillations which were predicted to occur on lines whose saturated gain does not fill the unstable resonator were measured. The time-dependent oscillations had a period of abour 40 ns independent of flow rates, do not occur for Fresnel numbers less than 1.5, and their amplitudes increased as the fraction of the resonator filled by the saturated gain of the oscillating line decreased.

5084 (AD-A—143027/1) Thomson backscattering from an intense relativistic electron beam as a diagnostic for a free-electron laser. Interim report. Chen, S.C.; Marshall, T.C. (Columbia Univ., New York (USA). Plasma Physics Lab.). Apr 1984. 113p. NTIS, PC A06/MF A01.

The parallel momentum spread of an intense relativistic electron beam (1 kA/CC, 700 kV) used in a Raman free-electron laser, is determined by a Thomson backscattering experiment. Theory is reviewed to show that the relativistic effect combines with the backscattering geometry to provide maximum energy resolution, sensitivity, and scattered signal level for the energy diagnostic experiment. The electron beam is field-emitted from a cold cathode, apertured by the anode, and guided by a 9.5 -kG magnetic field to scatter the 20-MW peak power, mode-locked 9.6 micrometer CO_2-laser radiation. The electron beam is found to have adequate qualities for Raman free-electron laser applications: A normalized beam energy spread of (0.6 + or - 0.14) % is obtained from the frequency-upshifted backscattered spectrum centered at 0.5 micrometer. It is also found that the use of the 1.7 cm period radially dependent undulator field introduces extra inhomogeneous broadening on the electron beam -- the momentum spread increases monotonically with the undulator field strength.

5085 (BMFT-FB-T—84-131) Laser diodes for infrared spectroscopy. Heime, A.; Henkel, H.; Junkersfeld, B.; Maier, W.; Matthes, H.; Meier, I.; Pfeiffer, H.; Wurzinger, H.D.; Grisar, R.; Schneider, F. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Allgemeine Elektricitaets-Gesellschaft AEG Telefunken, Frankfurt am Main (Germany, F.R.). Forschungsinstitut). Jul 1984. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE84752275.

A reliable procedure for the preparation of long-wavelength diode lasers for the spectral range of 8-20 μm is the stripe-diffusion of cadmium into Pbsub(1-x)Snsub(x)Se. Model calculations for such lasers showed diffused homostructures to exhibit similar properties as those obtained for double-heterostructures for shorter wavelength lasers. With given Pbsub(1-x)Snsub(x)Se substrate parameters properly chosen diffusion parameters the laser properties can be controlled. These properties are the maximum operating temperature (and thus the tuning range) as well as mode behaviour and output power. In view of short-wavelength lasers for the range of 2,5-4 μm, heterostructures based on Pbsub(1-x)Cdsub(x)S have been prepared by means of hot-wall epitaxy and suitable contact materials have been found. The sublimation growth for the production of PbSnSe and PbCdS crystal substrates is to a large extent standardized. Test equipment for the characterization of materials and diodes has been developed or improved.

5086 (N—84-25039) Model calculations for a CO2 mixing laser with screen nozzle. Schall, W.; Huegel, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Stuttgart (Germany, F.R.)). Dec 1983. 140p. (DFVLR-FB—83-41; ESA-TT—859). NTIS, PC A07/MF A01.

A semi-empirical, one dimensional model for a gasdynamic CO2 laser with screen mixing nozzle is presented. The calculation of profiles of small signal gain, available energy, and bounds for the laser power along the flow direction was based on the assumption of a finite mixing length. The calculated distributions were compared with experimental results and allow for their physical interpretation. Proposals for improving an existing laser are presented. Upper limits to the power of this particular device and for screen nozzle mixing lasers in general were determined based upon physically and technically realistic initial conditions.

5087 (N—84-26020) Characteristics of a plasma-injection-controlled discharge for CO2 mixing lasers. Mcleary, R.; Beckwith, P.J. (Materials Research Labs., Melbourne (Australia). Physics Div.). Apr 1984. 22p. (MRL-R—922; AR—003-904). NTIS, PC A02/MF A01.

The characteristics of continuous electric discharges which were used in high power carbon dioxide mixing lasers are outlined. The discharges in nitrogen at atmospheric pressure are stabilized by the plasma injection technique. Discharge characteristics are presented for a range of discharge dimensions, preionizing discharge currents and gas flow rates. Specific input energies as high as 900 kJ/kg are accomplished.

5088 (PNL-SA—12594) 1315 nm dielectric mirror fabrication by reactive sputtering. Pawlewicz, W.T.; Martin, P.M.; Griffin, J.W.; Temple, P.A. (Pacific Northwest Lab., Richland, WA (USA); Naval Weapons Center, China Lake, CA (USA)). Oct 1984. Contract AC06-76RL01830. 21p. (CONF-8410186—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003118.

From Symposium on optical materials for high power lasers; Boulder, CO, USA (15 Oct 1984).

Progress in an on-going effort to fabricate improved laser mirrors from reactively sputtered amorphous oxides (Nb, Ta, Ti, Si), nitrides (Si), and semiconductor alloys (Si:H) is reported. Optimum coating materials have been selected for use at 1315 nm. Materials for shorter wavelengths are also suggested. Supporting data include laser calorimetric absorption coefficients, surface roughnesses deduced from total integrated scattering, refractive indices, and residual mechanical stress levels. An automated reactive gas exchange technique is described for mirror fabrication. Laser calorimetry, total integrated scattering and environmental stability results are presented for fabricated mirrors. Reflectances greater than 0.999 have been achieved.

5089 (UCRL—91476) Optical guiding in a free electron laser. Scharlemann, E.T.; Sessler, A.M.; Wurtele, J.S. (Lawrence Livermore National Lab., CA (USA); Lawrence Berkeley Lab., CA (USA)). 16 Oct 1984. Contract W-7405-ENG-48. 26p. (CONF-8409163—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85003141.

From Workshop on coherent and collective properties of relativistic E-beams and electromagnetic radiation; Villa Olmo, Como, Italy (13 Sep 1984).

The coherent interaction between an optical wave and an electron beam in a free electron laser (FEL) is shown to be capable of optically guiding the light. The effect is analyzed using a two-dimensional approximation for the FEL equations, and using the properties of optical fibers. Results of two-dimensional (cylindrically symmetric) numerical simulations are presented, and found to agree reasonably well with the analytically derived criterion for guiding. Under proper conditions, the effect can be large and has important applications to short wavelength FEL's and to directing intense light.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 4204004264, 4280, 4611, 4742, 5042

5090 **(AD-A—142886/1) Fundamental study of three-dimensional two-phase flow in combustion systems. Final report for period ending June 1983.** Swithenbank, J.; Ewan, B.C.R.; Boysan, F.; Ayers, W.H.; Malebran, S.V. (Sheffield Univ. (UK). Dept. of Fuel Technology and Chemical Engineering). 20 Dec 1983. 81p. NTIS, PC A05/MF A01.

Details are presented on the latest developments in the mathematical modelling of turbulence with particular reference to the pressure strain transport term. Comparisons are made of the radial variations of normal and shear stress with published data for a round jet and for decay of turbulence for selected flow fields. Work is also reported on the measurement and calculation of flow fields inside a dump combustor using swirl and baffle stabilization. The value of the different turbulence approximations in predicting the flow are discussed.

5091 **(DFVLR-FB—84-22) Mathematical models for the boiling diagram of the ideal two-component mixture.** Moellenbruck, W. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1984. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750262.

The boiling diagram (boiling curve and dewing curve) can be drawn from the vapor messure diagram with the help of Dalton's and Raoult's law. The paper points out interesting dependencies of both diagrams at different models. Both diagrams are used to draw concentration enthalpy diagrams of mixtures for absorption pumps for refrigeration or heating.

5092 **(FEI—1487) Temperature field measurement in a water flow during mixed forced-and-natural convection.** Kapinos, G.A.; Remizov, O.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703264.

A temperature profile has been measured over the tube length different zones of the unstable heat exchange during mixed forced-and-natural convection. The heated tube 3 m long and 24 mm in inside diameter is made of stainless steel. The tube wall temperature was measured by 29 chromel-alumel thermocouples with an electrode diameter 0.3 mm, welded up to the external tube wall. A mobile chromel-alumel thermocouple was introduced through a connection to measure the temperature of a water flow inside the tube. The junction of a mobile thermocouple was spaced at different lengths from the tube wall, and 12 to 15 temperature measurements have been taken at a rate of 1 meas./s. An amplifier ubandwidth was within the range 0-5 Hz. The amplitude of flow temperature fluctuation reached 10 deg C. The experiments were carried out at the 6.0 MPa pressure, with the water temperature at the input being equal to 100 deu C, mass velocity = 200, 300 kg/m^{2}xs specific heat flux density on the wall - up to 200 kW/m^2 and the Reynolds numbers - (2-3)x10^4. The features disclosed of the flow temperature profile over the tube radius in zones of different heat exchange pattern allow to draw a conclusion on the heat exchange mechanism during the mixed forced-and-natural convection effect.

5093 **(FEI—1494) Determination of interchannel oscillation region boundaries in a system of parallel steam-generating channels.** Shvidchenko, G.I.; Kulikov, B.I.; Sudnitsyn, O.A.; Yarkin, A.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703265.

The results of experimental study on self-excited oscillation processes in the system of parallel steam generating channels are presented. The criterion for the description of interchannel oscillation region boundaries is suggested. A criterion suggested check has been carried out on the basis of experimental data obtained. The study of interchannel oscillations has been carried out at two identical steam-generating channels joined up by inlet and outlet collectors. Each channel had an inlet unheated section with an accessory throttling orifice at the inlet, a heated operating section an outlet unheated (lifted) section with accessory throttling orifices at the inlet and outlet. The investigations have been carried out in the following parameters ranges: pressure - 6.0, 12.0, 16.0 MPa, heat flux - 0.375, 0.5, 0.75 MW/m^2, mass rate - 110-600 kg/m^{2}xs, the inlet temperature - from 40 deg C, the coefficient of local resistance at the inlet - 13.0, 52.0 and at the outlet of the lifted section - 16.0, 5.0, 10.0. It is shown that the criterion suggested describes well the interchannel oscillation region boundaries.

5094 **(GKSS—84/E/24) Void fraction measurements performed in a vertical large diameter tube compared to different predicting correlations.** Katsaounis, A.; Kuehns, M. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 20p. (CONF-8406214—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750263.

From European two-phase flow group meeting; Rome, Italy (18 Jun 1984).

For the calculation of the two-phase flow form-resistance coefficient in a T-junction the knowledge of the void fraction in vertical tubes of the junction is needed. In the vertical branch both steady state and oscillating two-phase flow conditions were observed. The void fraction measurement are compared with the correlation given by Zuber and Findlay, Nabizadeh, and a numerical approximation of the Marchaterre and Hoglund diagram. The different correlations can be used favourably only in particular ranges of the flow regimes as the comparison with the measured values indicate.

5095 **(NP—5770006) Effect of blowing and sucking of permeable walls on flow with high Reynolds numbers.** Wiedemann, J. (Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau). 20 Jul 1983. 156p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770006.

The effect of blowing and sucking on external flow and on the boundary layer for stationary, leven and incompressible flow on permeable walls is examined. Laminar and turbulent boundary layers are considered separately. In the case of laminar boundary layer flow, the question is discussed, using theoretical and experimental investigations on a thin Joukowsky profile and on circular cylinders, at what blowing-sucking volume there is a transition to asymptotic solutions for strong blowing or sucking. Special attention is paid to the reduction of resistance which can be achieved, including the effects of higher orders, and the optimization of standard speed distribution on the wall. Asymptotic methods for classifying orders of magnitude for turbulent boundary layers with weak blowing and sucking are discussed, and the results are compared with known relationships. Based on results of boundary layer measurements on porous walls, an expanded asymptotic concept is introduced, which can take strong blowing into account.

5096 **(NP—5770007) Contribution to characterize turbulent shear layers with disturbed turbulence structure.** Kiske, S. (Bochum Univ. (Germany, F.R.). Abt. fuer Maschinenbau). 20 Jul 1983. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770007.

Experimental and theoretical investigations from various points of view were carried out to describe the turbulent shear layers with disturbed turbulence structure. Starting from the analysis of experimental results, a process of calculation is introduced for an important class of flow, which is marked by common properties regarding the disturbed state of the turbulence structure, where important physical properties of the flow during the recovery process to the equilibrium turbulence structure are represented by empirical laws and constraints. A detailed investigation of the physical processes in shear layers with disturbed turbulence structure is carried out experimentally and theoretically with the example of periodic disturbing movement in channel flow. The theoretical part of the investigation is based on the estimation of the order of magnitude of terms of the time-dependent equation, which describes the behaviour of the disturbing movement. The particular importance of this type of investigation is due to the fact that the effect of characteristic "time" parameters (e.g. the frequency of disturbing movement on the attenuation behaviour of the disturbance) can be examined.

5097 **(NP—5770008) Heat transfer and pressure drop with-two phase flow.** Hassdenteufel, W. (Stuttgart Univ. (Germany, F.R.). Fachbereich Energietechnik). 19 Nov 1982. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770008.

Development of methods of prediciton, in order to create a basis for calculating heat transfer and pressure drop with two phase flow. An experimental investigation of the heat transfer and pressure drop in the area of bubble and foam flow in a vertical pipe was carried out. The results show that in the area of bubble flow, heat transfer can be calculated with the aid of an homogeneous model. In the area of foam flow, a correlation of experimental results is only possible using the Chen equation for forced convection. The results of pressure drop measurements show that the calculated pressure drop due to change of height is equal to or greater than the measured total pressure drop. This gives a negative friction loss.

5098 **(NP—5770010) Experiments performed in a wet-steam turbine plant studying droplet formation and growth with expansion into the two-phase area.** Mertens, K. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 19 Mar 1982. 132p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770010.

The comparison between experimentally and theoretically obtained results is based on both pressure gradients and droplet number and droplet size distribution measured by a light-scatter probe. Apparently, spontaneous condensation by droplet formation in the first turbine stage and in the condensation channel is largely suppressed. Results of studies with steam from a steam conversion facility indicate that water injected for the necessary control of steam temperature generates additional condensation nuclei causing a shift of condensation onset towards the balance dew line.

5099 **(NP—5770018) Influence of overlaying tangential and radial coolant injection on film cooling with a tube flow.** Reinheimer, G. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 11 May 1983. 171p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770018.

A model was developed allowing predictions of cooling effectiveness to be expected with combined cooling-air feed and employing the Runge-Kutta method. Concurrent measurements showed an increase of cooling effectiveness proportional to the velocity ratio. Recording of the temperature fields by means of holographic interferometry shows that, downstream from the coolant flow inlet, a separation bubble forms whose length is proportional to the velocity ratio of the coolant and mainstream flows. Concerning cooling effectivity, it is possible to indicate an optimum distribution of a preset total cooling-mass flow across both partial flows.

5100 **(NP—5770020) Three dimensional quasi-stationary measurement of the relative flow field in the blade duct of a slow running centrifugal pump rotor.** Korcian, J. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 20 Dec 1982. 172p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770020.

In order to measure the relative flow field in the blade duct of a centrifugal pump rotor, a three-dimensional probe with six holes was fitted in the rotor duct. The measurements were carried out at several cylinder sections, where operation was in the part-load and in the overload range. The results confirm the observed deviations between actual and theoretical, calculated flow. In addition, the thesis gives information on the course of the meridian flow angle as a function of location and volume flow. Further, there are data on the reduced load factor in the outlet cross-section. Summarising, one can say that the very different processes of approximation for determining the reduced load factor give very different results for the same process.

5101 **(SFB—80/T/216) Computation of strongly swirling axi-symmetric free jets.** Leschziner, M.A.; Rodi, W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Sonderforschungsbereich Ausbreitungs- und Transportvorgaenge in Stroemungen). Apr 1983. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84752269.

Finite-difference computations have been performed of strongly swirling circular free jets operating at swirl numbers of 1.18 and 1.3. These values are sufficiently high for recirculation to occur near the jet nozzle. The study focuses on the response of the computed flow-field to the introduction of swirl-related modifications into the k-epsilon model of turbulence, and to changes in the boundary conditions for the dissipation rate epsilon and the radial velocity V at the computational jet inlet plane. It is shown that the inlet conditions for V and epsilon, usually considered of subordinate importance, play as crucial a role in achieving predictive accuracy as turbulence-modelling details. It is in particular found that, with a realistic V-distribution prescribed at the jet-inlet plane, satisfactory predictions can be obtained without any swirl-specific modifications to the k-epsilon model. While it is not argued that such modifications are generally redundant and inappropriate, it is suggested that any attempt to identify and rectify turbulence-model defects is bound to be frustrated unless comprehensive experimental data for all flow properties at the jet-exit become available.

5102 **Pressure drop fluctuations and bubble-slug transition in a vertical two phase air-water flow.** Tutu, N.K. (Dept. of Nuclear Energy, Brookhaven National Laboratory, Upton, NY). *International Journal of Multiphase Flow;* **10**: No. 2, 211-216(Apr 1984).

Evolution of the probability density function of pressure drop fluctuations with increasing volumetric quality in a vertical two phase air-water flow is presented. The measurements are used to develop two quantitative criteria for identification of the bubble-slug transition.

5103 **Low-pressure transient flow film boiling in vertically oriented rod bundles.** Loomis, G.G.; Shumway, R.W. (EG and G Idaho Inc., Idaho Falls, ID). *Nuclear Technology;* **63**: No. 1, 151-163(Oct 1983).

Flow film boiling heat transfer data from Semiscale Mod-3 gravity feed reflood experiments have been compared to existing film boiling correlations. The existing film boiling correlations were found to be inadequate for calculating Semiscale rod bundle results in the low void fraction region. Therefore, a new correlation for flow film boiling was developed. The new correlation is applicable for boiling water with stainless steel electrically heated vertical rods for a pressure range from 127 to 390 kPa. The new correlation is sensitive to such parameters as the local void fraction, the wall temperature, the bulk vapor temperature, and the total mass flux.

4205 Materials Testing

REFER ALSO TO CITATION(S) 4205004762, 5077

5104 **(FRP—81/11) C.O.D. toughness testing of medium strength steel as a preliminary development for single specimen J integral toughness tests of SA533-B steel.** Dean, P.; Tait, R.B.; Garrett, G.G. (University of the Witwatersrand, Johannesburg (South Africa). Dept. of Metallurgy). Oct 1981. 119p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85780199.

The primary purpose of this project is to set up a test facility and to develop the necessary expertise to enable reliable elasto-plastic fracture toughness tests to be performed. Initially, tests are to be conducted on material similar to that used in the Koeberg pressure vessel walls, with the ultimate goal of performing single specimen J integral tests on the pressure vessel steel itself to determine through-thickness toughness variations. The project will comprise a number of stages, each one necessary for the development of the techniques used in J integral testing. These include: (i) development of an appropriate specimen design, of suitable size and shape that is applicable to both crack opening displacement (C.O.D.) and J integral tests; (ii) development, testing and calibration of the necessary

associated mechanical and electrical equipment (e.g. clip gauge, amplifiers, interface unit, etc.), with (iii) an estimation of the probable errors and noise levels with a view to their elimantion, leading to (iv) perfection of the sensitivity and reproducibility of, firstly, the multiple specimen C.O.D. technique and, secondly, the multiple specimen J integral techniques. (v) Based on the above techniques, development of the single specimen J integral test method incorporating development of a computerised testing procedure. All the above procedure is to be conducted on similar, but non-Koeberg pressure vessel material ('ROQ Tough'). (vi) Finally, development and testing of both multiple specimen and single specimen J integral tests on actual SA533B material and an investigation of the through thickness toughness and fatigue crack propagation behaviour.

5105 **(IS-M—526) Elastic compliance of imperfect interfaces: review and relationship to ultrasonic scattering.** Baik, J.M.; Thompson, R.B. (Ames Lab., IA (USA)). 1984. Contract W-7405-ENG-82. 13p. (CONF-840738—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003068.

From Progress in quantitative NDE; San Diego, CA, USA (8 Jul 1984).

When a tensile load is applied to an elastic solid with an imperfect interface containing cracks or voids, the farfield displacement that would occur in the absence of the interface will be increased by localized deformations. This extra extension can be modeled as the response of two half-spaces connected by a distributed spring. The spring stiffness per unit area, κ, is a function of the topography of the partially contacting surfaces. If ultrasonic energy with wavelength large with respect to the contact separation illuminates the interface, a set of modified boundary conditions involving the interface stiffness κ has been found to correctly predict the frequency dependence of reflection and transmission. The distributed spring or eqivalent models have proved to be useful tools in ultrasonic measurements of partially contacting interfaces in studies of friction, fatigue crack closure, adhesive bonding, and shape memory couplers. This paper reviews these results and extends them to the case in which inclusions are present at the interface. The modified boundary conditions are first derived and their utility is verified by comparison to exact solutions. The relationship between κ and the interfacial topography is then discussed for several special cases of interest. 17 references.

5106 **(JAERI-M—83-089) Design and construction of accelerated aging facility for cables.** Seguchi, Tadao; Ito, Hiroshi; Yoshida, Kenzo. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 22p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703278.

In order to establish the accelerated aging methodologies for testing the electrical cables used in the containment of a nuclear reactor under normal operating conditions, "Accelerated Aging Facility for Cables" was designed and constructed. In this facility, cables are irradiated with Co-60 γ-rays in oxygen under pressure at elevated temperatures; maximum oxygen pressure is 20 bar (Kg/cm^2) and maximum temperature is 200°C (author).

5107 **(REG/G—10.6-Rev.2) Guide for the preparation of applications for the use of sealed sources and devices for performing industrial radiography. Proposed revision 2 to regulatory guide 10.6.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Oct 1984. 38p. NTIS, PC A03/MF A01. File Number TI85900296.

The purpose of this regulatory guide is to provide assistance to applicants and licensees in preparing applications for new licenses, licenses amendments, and license renewals for the use of sealed sources and devices for performing industrial radiography. The term radiography as used in this guide means the examination of the structure of materials by nondestructive methods that use gamma-emitting byproduct materials (radioisotopes). The radioisotopes most commonly used for radiography are cobalt-60 and iridium-192.

5108 **(ZJE—259) Contribution to the theory of polarization resistance method for corrosion testing of metals.** Beran, J. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780201.

A theoretical analysis is presented of the polarization resistance method for corrosion metal testing. The method is based on the relationship Rsub(p)=B.isub(corr)sup(-1) where Rsub(p) is corrosion resistance, B the conversion factor and isub(corr) is corrosion current density. The existence is confirmed of the temperature independent conversion factor, the method is described of the practical determination of this factor and a comparison is made of published values of the conversion factor for different metals and different corrosion media. The application of the polarization resistance method in the indication of local defects of passive films and for industrial corrosion monitoring under severe conditions (elevated temperature, pressure, radiation hazard) is discussed.

5109 **Radiation-induced impulse on a spherical shell.** Forrestal, M.J.; Sagartz, M.J. (Sandia National Labs., Albuquerque, NM). *International Journal of Impact Engineering;* 2: 81-84(1984).

Formulas for the membrane response of a thin, elastic, spherical shell to a radiation-induced impulse load are derived and some numerical results are presented. 6 references.

4206 Safety Engineering

REFER ALSO TO CITATION(S) 4206004270, 5107, 5563

5110 **(Juel-Spez—252) Trend analysis of boiler explosions aboard ships.** Bull, D.C.; Hoffmann, H.J.; Ott, K.O. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Forschungsgruppe Wirtschaft, Energie, Investitionen). Apr 1984. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84752279.

The historical development of steam boiler technology aboard steam- and later motor-ships is reviewed, setting the stage for statistical investigations of longer term trends in the frequency of boiler explosions. Two different measures of the safety performance have to be addressed in such an analysis: The explosion rate per ship- or boiler-year in an entire fleet, and the failure ratio, i.e. the probability that a boiler of a certain vintage suffers an explosion during its useful life. The major obstacle for both analyses, the distortions due to statistical fluctuations, have been dealt with by applying a special smoothing procedure. The failure ratio analysis requires further an estimation of failures to be statistically expected in the future; this is accomplished by means of a previously developed methodology. This paper is primarily concerned with the statistical analysis of boiler explosion data. The methodology is published elsewhere.

5111 **(SRD-R—238) Transition from pressure-energy to gravity-driven slumping during catastrophic release of a denser-than-air gas.** Jagger, S.F. (UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate). Dec 1982. 14p. UKAEA, Wigshaw Lane, Culcheth Warrington, WA3 4NE, England. File Number TI85900242.

A catastrophic release of a liquid, stored under pressure and above its boiling point, is considered. Models for the initial pressure-energy driven expansion, the gravitationally-driven slumping and passive phases are taken and the possible modes of dispersion are investigated. It is found that the way in which a heavy vapor disperses is dependent on the mass of contaminant released with different dispersion phases predominant at different times. Implications for the scaling of releases are discussed. 21 references, 1 figure, 1 table.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 4208005972

5112 **(MLR—1807) Rep rated long life capacitor development. Final report, 1 April 1981-31 May 1984. Phase I and II.** Galperin, I.; White, W.; Haskell, K.; Ennis, J. (Maxwell Labs., Inc., San Diego, CA (USA)). Sep 1984. Contract AC04-81AL16320. 97p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85000719.

Polypropylene and polyolefin resins were characterized and processed into capacitor films. New capacitor films were developed–a post oriented processed, two layer polypropylene film and upgraded polyolefin film. Criteria for judging film quality was developed. Field life data was verified with paper/polypropylene capacitors on the Maxwell Rep Rate Facility. All polypropylene film capacitors were developed with lifetimes in excess of 10^7 discharges at energy densities for the finished capacitor of 18.3 J/lb and projected to > 20 J/lb.

5113 **Infrared photoemitting diode having reduced work function.** Hirschfeld, T.B. (to Dept. of Energy). US Patent 4,464,572. 7 Aug 1984. Filed date 6 May 1982. vp.

PAT-APPL-375518.

In electro-optical detectors which include as elements a photoemitting photocathode and anode, a photoemitting diode is fabricated which lowers the diode's work function, thus reducing the cooling requirement typically needed for this type of device. The work function is reduced by sandwiching between the photocathode and anode a liquid medium of the formula NR_3 and having an electron affinity for the electrons of the photocathode, which liquid medium permits free electrons leaving the photocathode to remain as stable solvated species in the liquid medium. Thus, highly light-absorbent, and therefore thin, metallic layers can be used for detection, thereby reducing dark current at a given temperature, with a consequent reduction in cooling requirements at constant detector performance.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 4209005068, 5322, 5324, 5392

4210 Combustion Systems

REFER ALSO TO CITATION(S) 4210004604, 5090, 5110

5114 **(DOE/ET/12307—1669) Design, construction, operation, and evaluation of a prototype culm combustion boiler/heater unit.** D'Aciermo, J.; Richards, H.; Spindler, F. (Shamokin Area Industrial Corp., PA (USA)). Oct 1983. Contract AC21-78ET12307. 128p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001963.

A process for utilizing anthracite culm in a fluidized bed combustion system was demonstrated by the design and construction of a prototype steam plant at Shamokin, PA, and operation of the plant for parametric tests and a nine month extended durability test. The parametric tests evaluated turndown capability of the plant and established turndown techniques to be used to achieve best performance. Throughout the test program the fluidized bed boiler durability was excellent, showing very high resistence to corrosion and erosion. A series of 39 parametric tests was performed in order to demonstrate turndown capabilities of the atmospheric fluidized bed boiler burning anthracite culm. Four tests were performed with bituminous coal waste (called gob) which contains 4.8 to 5.5% sulfur. Heating value of both fuels is approximately 3000 Btu/lb and ash content is approximately 70%. Combustion efficiency, boiler efficiency, and emissions of NO/sub x/ and SO_2 were also determined for the tests.

5115 **(SVF—148) Design velocities for flue gas in stack, when using solid fuel.** Fransson, K. (Stiftelsen foer Vaermeteknisk Forskning, Stockholm (Sweden)). Dec 1983. 18p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750208.

Based on the regulations concerning the design parameters for flue gas velocity in the stack in oil-boiling burners, this study is supposed to convert these regulations for solid fuels. The study shows that the choice of maximum and minimum velocity for the flue gas, when calculating the stack diameter, is based on experience and not calculation, which makes it impossible to recalculate in order to fit into the particle properties special for solid fuels. To be able to change the rules of today or make sure they fit to solid fuel, it is necessary to make extensive data sampling under different particle load at different flue gas velocities. The main reasons for minimum velocity is the settling velocity as well as the adhesiveness of the particle. The maximum velocity is set because of noise.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 4220004763

4230 Marine Engineering

5116 **Numerical simulation of undersea cable dynamics.** Ablow, C.M.; Schechter, S. (SRI International, Menlo Park, CA). *Ocean Engineering;* **10**: No. 6, 443-457(1983).

A fully three-dimensional code has been written to compute the motion of a towed cable. The code is based on a robust and stable finite difference approximation to the differential equations derived from basic dynamics. A 3500-ft cable pulled at 18.5 knots (hr^{-1}) through a circular turn of 700 yd radius has been computed in about half of the real time of the maneuver. The computed displacements are close to the measured ones; the changes in depth are within 2%.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 4240004198, 5331

5117 **(PB—84-222215) Emissions testing of industrial processes burning hazardous-waste materials.** Olexsey, R.A.; Mournighan, R.E. (Environmental Protection Agency, Cincinnati, OH (USA). Industrial Environmental Research Lab.). Jul 1984. 35p. (EPA/600—D-84-173). NTIS, PC A03/MF A01.

Hazardous-waste incinerators are regulated under the Resource Conservation Recovery Act (RCRA). On the other hand processes that produce energy and only incidently burn hazardous-waste materials are currently exempt from the RCRA incinerator regulations. EPA has initiated a Regulatory Impact Analysis (RIA) to determine if and to what degree regulation of such processes may be required. As part of the RIA study, EPA has conducted field tests of industrial processes that burn hazardous-waste materials. This paper describes the testing and results of testing of two industrial boilers and a lime kiln that burned hazardous-waste materials during the test program. Data on emissions and plant operating conditions that existed during emission measurements are presented. The hazardous compounds burned ranged from non-halogenated solvents to high-chlorinated materials such as trichloroethylene. Calculated destruction efficiencies for the hazardous compounds were in the range of from 99.929 to 99.9999.

5118 **(PB—84-229749) Fabric filter system study; fourth annual report. Report for October 1980-June 1984.** Chambers, R.L.; Plunk, O.C.; Kunka, S.L. (Southwestern Public Service Co., Amarillo, TX (USA)). Aug 1984. 68p. NTIS, PC A04/MF A01.

The report gives results of the fourth year of operation (ending October 1, 1981) of a fabric filter installed by Southwestern Public Service Co. on its Harrington Station Unit 2 coal-fired boiler in Amarillo, Texas. Project work during the fourth year concentrated on fabric studies. The 10-oz/sq yd fabrics of the 150 1/2 warp, 150 2/2T fill construction demonstrated superior performance over the most common 14-oz/sq yd constructions, regardless of coating. It was determined that improving cleaning by increasing shaking amplitude is more detrimental to baglife than increasing shaker frequency. Maintenance and operation observations contin-

ued, and the resolution of these types of problems became more efficient because of increased experience of maintenance personnel with baghouse-related problems.

5119 **(PB—84-231448) Development of a new gravity sedimentation process for dewatering flue-gas-cleaning wastes. Final report May 1976-June 1983.** Tarrer, A.R. (Auburn Univ., AL (USA). Dept. of Chemical Engineering). Aug 1984. 238p. NTIS, PC A11/MF A01.

The report gives results of a project to develop and test a novel system for dewatering flue gas cleaning (FGC) wastes at the pilot plant level. In this new system, the clarification and thickening functions are conducted in separate, but interconnected, pieces of equipment. The new system consists of a lamella clarifier and a conventional thickener that is smaller in diameter, but deeper (than the thickener/clarifier typically used to dewater FGC wastes), connected by a recycle stream between the two units to obtain a high degree of flexibility and control of operating conditions. Preliminary economic evaluation of this system indicates potential savings of 10 percent of the total capital costs and 6 percent of annual operating costs for the FGC waste management/disposal system. In pilot testing of this system, a completely new concept in thickener operation, known as the 'bang-bang' operation, evolved in which the thickener underflow rate is set as low as possible without plugging the underflow lines. Periodically, the underflow rate is increased briefly to remove additional solids from the system at the concentration established by the (previously set) low underflow rate. This mode of operation appears to make it possible to maintain the maximum solids concentration in the underflow.

5120 **(PB—84-232503) Status of dry SO_2 control systems: Fall 1983. Final report August 1983-July 1984.** Palazzolo, M.A.; Baviello, M.A. (Radian Corp., Research Triangle Park, NC (USA)). Aug 1984. 146p. NTIS, PC A07/MF A01.

See also PB83-247585.

The report, on the status of dry SO_2 control for utility and industrial boilers in the U.S., reviews curent and recently completed research, development, and commercial activities. Dry SO_2 control systems covered include: (1) spray dryers with a fabric filter or an electrostatic precipitator (ESP), (2) dry injection of alkaline material into flue gas accompanied by collection of product solids and fly ash in a fabric filter or an ESP, and (3) electron-beam (E-beam) irradiation. Spray drying and dry injection systems generally include a fabric filter or an ESP and control SO_2 and particulate matter simultaneously; E-beam technology is designed to also control NOx. Spray drying continues to be the only technology commercially applied to utility and industrial boilers. The two new utility systems sold since the last status report (Fall 1982) bring the total utility spray drying flue gas desulfurization (FGD) capacity to about 7200 MWe. Also, 10 recently sold new industrial units bring the total of commercial industrial boiler unit sales to 21. Performance data for five utility systems and three industrial systems were recently published. Some full-scale systems that have come on-line since the last survey have experienced atomization problems and solids buildup on the dryer walls during initial operation. The first trona dry injection application has been announced for a 500 MWe unit.

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 4300005216, 5222, 5228

5121 **(SUNI—66) Chairman's report for period 1 April 1979 to 31 March 1981.** De Villiers, J.W.R. (Southern Universities Nuclear Inst., Faure (South Africa)). 1981. 31p. (In English, Afrikaans). (KISU—66). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703318.

The report gives an account of the activities of the Southern Universities Nuclear Institute for the period 1979-1981. A short discussion of basic and applied research programmes undertaken during this period is given. Nuclear level parameters using charged particle induced reactions were studied. Mono-energetic neutron sources obtained from the SUNI accelerator were calibrated. Prompt nuclear methods have been extensively studied. The main part of the solid state and materials research programme constituted thin film semiconductor studies with much attention being given to metal silicides. With regard to atomic physics, research on the energy level structure of highly ionized rare gases was continued and the spectrum of krypton analyzed. Projects of biomedical interest were also undertaken, mainly with regard to trace elements. Nuclear techniques were also applied to industrial and environmental problems.

4301 Design, Development, And Operation

5122 **(AD-A—142819/2) Bumpy torus betatron. Interim report.** Chernin, D.; Mondelli, A.; Roberson, C. (Naval Research Lab., Washington, DC (USA)). 22 May 1984. 11p. (NRL-MR—5327). NTIS, PC A02/MF A01.

The combination of a bumpy torus field and a conventional betatron field leads to an interesting strongly focused, high-current accelerator configuration. The question of orbital stability of a test particle in such a device is discussed, and it is shown that the alternating gradient focusing in this accelerator can easily lead to greater than 20% bandwidth in allowed mismatch between the vertical magnetic field and the average beam particle energy.

5123 **(AD-A—142822/6) Longitudinal and transverse instabilities in a high-current modified betatron electron accelerator. Interim report.** Sprangle, P.; Vomvoridis, J.L. (Naval Research Lab., Washington, DC (USA)). 17 May 1984. 25p. (NRL-MR—4688). NTIS, PC A02/MF A01.

In this paper we derive a general dispersion relation which describes the longitudinal and transverse instabilities on an intense non neutral electron beam in a modified betatron field configuration. In a modified betatron, the usual betatron fields are supplemented by a strong toroidal stabilizing magnetic field. The negative mass kink, longitudinal resistive wall and transverse resistive wall instabilities have been analyzed in the new field configuration for an intense, non neutral, confined electron ring. Our model includes self field effects as well as induced field effects due to the image charges and currents on the toroidal chamber walls. The electron ring, which is assumed to have an energy spread, is taken to be located near the center of a toroidal chamber of finite conductivity. All the instabilities examined here are shown to significantly reduced by the presence of the strong toroidal magnetic field. In the limit of low beam current and no toroidal magnetic field our results reduce to the usual expressions. We find an unstable hybrid mode of oscillation which is a coupled azimuthal and longitudinal mode and exists at beam energies below the transition energy. The negative mass kink instability associated with and ultra high current (approximately 10 kA) modified betatron electron accelerator is analyzed and evaluated in some detail. Growth rate curves are given for various ranges of system parameters, including electron beam energy spread. It is found that with a moderate energy spread on a 10 kA injected electron beam, the negative mass kink instability can be stabilized.

5124 **(CONF-840937—19) Development of superconducting niobium accelerating structures for heavy ions.** Shepard, K.W.; Takeuchi, S.; Zinkann, G.P. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002545.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

Results of tests of two new designs for superconducting niobium resonant cavities are presented. Both types resonate at 145.5 MHz and accelerate most efficiently for particle velocities $\beta = v/c = 0.16$. One resonator is of the split-ring type, but of a simpler design than a previously reported $\beta = .16$ unit. Although the surface fields are higher, the performance is somewhat better than for the earlier design: an accelerating field E/sub a/ = 4.3 MV/m has been obtained at 4.2K with 4W of rf input, where E/sub a/ is defined as the energy gain per unit charge for a synchronous particle averaged over the interior resonator length. The other resonator is an 8-inch OD tapered coaxial quarter-wave line terminated with a drift tube of 1.50 inch aperture. At 4.2K, this resonator exhibits a low-level Q of 2×10^9, and has achieved E/sub a/ = 4.7 MV/m with 2.8W of rf input.

5125 **(CONF-8410172—4) Heavy ion de-acceleration with the Argonne Tandem-Linac Accelerator.** Pardo, R.C.; Cocke, L.; Richard, P. (Argonne National Lab., IL (USA); Kansas State Univ., Manhattan (USA)). 1984. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002740.

From Symposium of northeastern accelerator personnel; Stony Brook, NY, USA (15 Oct 1984).

The Argonne Tandem-Linac Accelerator system has been used to produce beams of 0.375 MeV/A ^{16}O 8^+ and 0.386 MeV/A ^{28}Si 13^+ and ^{28}Si 14^+ as a test of using the superconducting linac de-acceleration mode to provide highly stripped high charge state heavy-ion beams for use in atomic physics experimental programs. Such beams have been developed in the past at installations containing dual tandem electrostatic accelerators and the U. of Heidelberg tandem-linac facility. The beams in the tests reported in this communication were transmitted through the linac with an efficiency of 30 to 50% and can be delivered to a target location with a transmission efficiency of approximately 7%. These tests required the use of only 50 to 75% of the present linac. Energies down to 0.135 MeV/A should be possible using the entire linac but these lower energies will be accompanied by significant additional losses in transmission efficiency due to longitudinal and transverse emittance growth.

5126 (KEK—82-3, pp 175-180) **Modulated-ion-current vacuum gauge.** Watanabe, Fumio (Sakura-no-Seibo Gakuin Senior Highschool, Fukushima (Japan)); Hiramatsu, Shigenori; Ishimaru, Hajime. Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

A new type of ion gauges called "modulated ion current (MIC) vacuum gauge" has been developed to measure the pressure in an accelerator or a storage ring from a remote place with high accuracy. The head of this gauge electrostatically prevents the intrusion of secondary particles accompanying beam scattering by doubly shielded electrodes, and transmits the signal in the form of A.C. by installing a cylindrical modulator at the outlet of an ion source, so as to be hardly affected by external noise by adopting tuning amplification and phase identifying detection. By this method, the vacuum of the 12 GeV proton synchrotron in the National Laboratory of High Energy Physics was measured during beam acceleration at a distance of 120 m with high accuracy. In this report, its testing is described together with the measuring circuit and the gauge characteristics. The measured beam pipe pressure was 9.2×10^{-7} Torr during beam acceleration. Next, to examine the possibility of pressure measurement in an accelerator which requires ultrahigh vacuum, such as the TRISTAN electron ring, during beam acceleration, experiment was done by reducing electron emission down to 3μA, thus making the ion current about 1/500 of the normal value. The result showed that the vacuum measurement down to about 10^{-10} Torr is sufficiently feasible even if the noise of 10 mV or so exists. The features of this gauge are to avoid the effect of soft X-ray photons and electron bombardment desorption ions.

5127 **(KEK—82-11) NODAL interpreter for CP/M.** Oide, Katsunobu. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Nov 1982. 39p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703309.

A NODAL interpreter which works under CP/M operating system is made for microcomputers. This interpreter language named NODAL-80 has a similar structure to the NODAL of SPS, but its commands, variables, and expressions are modified to increase the flexibility of programming. NODAL-80 also uses a simple intermediate code to make the execution speed fast without imposing any restriction on the dynamic feature of NODAL language.

5128 **(UCRL—91040) Recent progress at RTNS-II.** Heikkinen, D.W.; Logan, C.M. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1984. Contract W-7405-ENG-48. 13p. (CONF-841117—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003137.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

The Rotating Target Neutron Source (RTNS-II) facility produces 14-MeV neutrons for materials damage studies. Initial operation for irradiations, which occurred in 1979, began with a neutron source strength of 10^{13} n/s utilizing one of the accelerator-based neutron sources. Details are given on improvements which have resulted in both increased neutron production and neutron source strength and improved control and monitoring. 8 references.

4302 Beam Dynamics, Field Calculations, And Ion Optics

5129 **(AD-A—143042/0) Filamental quenching of the current-driven ion-cyclotron instability. Progress report.** Cartier, S.L.; D'Angelo, N.; Krumm, P.H.; Merlino, R.L. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Jun 1984. 10p. NTIS, PC A02/MF A01.

Experimental evidence is presented on the effect of the finite width of the current channel for the excitation of the current-driven ion-cyclotron instability. The results are in agreement with the non-local theory of Bakshi, Ganguli, and Palmadesso.

5130 **(AD-A—143128/7) Measurement of linac bunch parameters using the cerenkov effect. Technical report.** Buskirk, F.R.; Neighbours, J.R. (Naval Postgraduate School, Monterey, CA (USA)). May 1984. 21p. (NPS—61-84-008). NTIS, PC A02/MF A01.

High energy electrons above about 25 MeV may produce microwave radiation in air by the Cerenkov mechanism. Electrons accelerated by a travelling wave accelerator are emitted in bunches. The radiation produced by such a beam in air should consist of the basic accelerator frequency and many harmonics. Here it is explored how the microwave harmonics may be used to determine the spatial structure of the bunches.

5131 **(CONF-8310338—1) 3D field calculation of the GEM prototype magnet and comparison with measurements.** Lari, R.J. (Argonne National Lab., IL (USA)). 28 Oct 1983. Contract W-31-109-ENG-38. 31p. NTIS, PC A03. File Number DE85003040.

From Mag-U-Comp conference; Milwaukee, WI, USA (28 Oct 1983).

The proposed 4 GeV Electron Microtron (GEM) is designed to fill the existing buildings left vacant by the demise of the Zero Gradient Synchrotron (ZGS) accelerator. One of the six large dipole magnets is shown as well as the first 10 electron orbits. A 3-orbit prototype magnet has been built. The stepped edge of the magnet is to keep the beam exiting perpendicular to the pole. The end guards that wrap around the main coils are joined together by the 3 shield plates. The auxiliary coils are needed to keep the end guards and shield plates from saturating. A 0.3 cm Purcell filter air gap exists between the pole and the yoke. Can anyone question this being a truly three-dimensional magnetostatic problem. The computer program TOSCA, developed at the Rutherford Appleton Laboratory by the Computing Applications Group, was used to calculate this magnet and the results have been compared with measurements.

5132 **(DOE/ER/40136—T2) Electron acceleration by laser fields in a gas. Progress report, January 1, 1984-September 30, 1984.** Fontana, J. (California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering). 1984. Contract AT03-84ER40136. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000575.

Two particular topics have been investigated, electron passes through Gaussian laser beams, and electron beam behavior in a scattering gas under laser field forces. A general description of each is given.

5133 (FNAL-TM—1254) Antiproton source beam position system. Bagwell, T.; Holmes, S.; McCarthy, J.; Webber, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). May 1984. Contract AC02-76CH03000. 45p. NTIS, PC A03. File Number DE84016716.

The TeV I Beam Position Monitor (BPM) system is designed to provide a useful diagnostic tool during the commissioning and operational phases of the antiproton source. Simply stated the design goal is to provide single turn position information for intensities of $> 1x10^9$ particles, and multi-turn (clocked orbit) information for beam intensities of $> 1x10^7$ particles, both with sub-millimeter resolution. It is anticipated that the system will be used during commissioning for establishing the first turn through the Debuncher and Accumulator, for aligning injection orbits, for providing information necessary to correct closed orbits, and for measuring various machine parameters (e.g. tunes, dispersion, aperture, chromaticity). During normal antiproton operation the system will be used to monitor the beam position throughout the accumulation process.

5134 (INS-NUMA—45) Lecture notes on high-current beam dynamics. Hofmann, I. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Dec 1982. 53p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703269.

This report contains material presented during a series of lectures held in summer 1982 at the Institute for Nuclear Study. The lectures were intended as a survey on the beam dynamics phenomena that arise due to space charge in transport lines, linear accelerators and storage rings (for heavy ion fusion) with high-current ion beams. Analytic methods of description have been described and compared with computer simulation. The main emphasis has been on a general discussion of beam properties in phase space, without referring to any specific accelerator.

5135 (ITEF—137(1983)) Coherent oscillations of strip beams in periodic transport channels. Zenkevich, P.R.; Korolev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703267.

In a general form taking as an example a simple one-dimensional strip beam model the coherent instabilities arising in the course of high-current beam transport and caused by the periodicity of the focusing system are investigated. The analysis of stability is performed assuming that the beam Coulomb field nonlinearity is small, coherent oscillations are described by the linearized system of the Vlasov equations and stationary distribution has a constant particle density in a phase space (water-bag type distribution). Resonance increments and instability band width are calculated and the threshold of Landau damping instability suppression is estimated. These estimations show that resonances with $n >= 3$ (where n is a number of transverse mode) are stabilized by betatron oscillation frequency spread related to the proper field nonlinearity.

5136 (KEK—82-13) Accurate method of the magnetic field measurement of quadrupole magnets. Kumada, M.; Sakai, I.; Someya, H.; Sasaki, H. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jan 1983. 21p. (CONF-8111151—). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703272.

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

We present an accurate method of the magnetic field measurement of the quadrupole magnet. The method of obtaining the information of the field gradient and the effective focussing length is given. A new scheme to obtain the information of the skew field components is also proposed. The relative accuracy of the measurement was 1×10^{-4} or less.

5137 (KEK—82-15) Some properties of longitudinal and transverse coupled-bunch instabilities. Kamiya, Yukihide. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Feb 1983. 74p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703277.

Some properties of longitudinal and transverse coupled-bunch instabilities have been investigated theoretically and computationally, mainly based on a rigid-bunch model. In this report, we will study Robinson's stability, sum rules of the instabilities and the cure of instabilities by producing the oscillation frequencies different from bunch to bunch, and also give the numerical examples for KEK-PF storage ring.

5138 (LBL—17634) Superconducting sextupole correction coil operating in persistent mode. Gilbert, W.; Borden, A.; Hassenzahl, W.; Mortiz, G.; Taylor, C. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 7p. (CONF-840937—20). NTIS, PC A02. File Number DE85001654.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

Error fields in a dipole due to superconductor magnetization and conductor misplacements add unwanted multipole, mainly sextupole and decapole, terms to the desired dipole field. Two persistent mode sextupole correction coils inside the bore of model SSC dipoles have been built and tested. A shorted superconducting sextupole coil has a current induced in it by the error sextupole field such that no sextupole field can penetrate into the proton beam region. The correction sextupole coils are one layer thick and are wound from a single length of insulated composite Nb-Ti and copper wire 0.60 mm in diameter. Each of the six poles has ten turns and is mounted on a 1.75 cm radius stainless steel bore tube. Details of testing and trimming of the correction coils are described. Test results of the measured magnetic field within the model SSC dipoles with the correction coils in and out of persistent mode operation are presented. An electrical heater is used to drive the coil out of the persistent mode. Measurements of joint resistance and coil decay time constants are also given.

5139 (SAND—84-1423C) Measurement of electron angle at MABE beam stop. Sanford, T.W.L.; Coleman, P.D.; Poukey, J.W. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 19p. (CONF-841010—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002639.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

The mean angle of incidence at the beam stop of a 60 KA, 7 MV annular electron beam, in the 20 kg guide field of the MABE accelerator, is determined. Radiation measured in TLD arrays mounted downstream of the stop is compared with the radiation expected using a CYLTRAN Monte Carlo simulation of the electron/photon transport in the stop as a function of incident angles and energies. All radiation profiles measured are well fit, if the electrons are assumed to be incident with a polar angle θ of 15° +- 2°. Comparing θ with that expected from the Adler-Miller model, and a MAGIC code simulation of beam behavior at the stop enables the mean transverse beam velocity to be estimated.

5140 (TRI-PP—84-47) π/K separation and kaon beam designs. Lobb, D.E. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Jun 1984. 3p. (CONF-8405193—47). NTIS (US Sales Only), PC A02/MF A01. File Number DE85900225.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

Pion contamination in low momentum ($\sim$ 0.5 GeV/c) kaon beam lines is discussed and criteria for the design of low contamination kaon channels are presented together with a sample design.

5141 Comment on "Unlimited electron acceleration in laser-driven plasma waves". Neuffer, D.V. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review Letters;* **53**: No. 10, 1026(3 Sep 1984).

A comment on the letter by T. Katsouleas and J.M. Dawson, Phys. Rev. Lett. 51, 392 (1983).

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 4303004405, 5126, 5265, 5510, 5649

5142 (ANL-HEP-CP—84-67) Triggering at a high luminosity hadron collider. Price, L.E.; Wagner, R.G.; Abolins, M.A. (Argonne National Lab., IL (USA); Michigan State Univ., East Lansing (USA)). 1984. Contract W-31-109-ENG-38. 5p. (CONF-8406198—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003041.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

The extreme interaction rate occurring at the SSC as described in the Reference Design Report poses the principal new challenge for the triggering system compared with detectors at previous accelerators. At SSC we must plan for about 10^8 interactions per second. If bunch crossings occur each 33 ns, there will be an average of 3 interactions in each bunch crossing. Potential problems for triggering are presented both by the high total rate and by the multiple interactions per bunch crossing, so that triggering events must be selected in the presence of other interactions independent of the inherent speed of either detector elements or triggering electronics. Three principal topics are considered in this report: (1) Practical selections to be made in a first-level trigger to reduce the rate by a factor of 1000. (2) Electronics expected to implement this first-level trigger, and (3) the ultimate trigger selections that must be used to select the approximately 1 Hz that can practically be recorded for detailed analysis. 11 references, 6 figures.

5143 (CONF-841007—27) DAPHNE: a parallel multiprocessor data acquisition system for nuclear physics. Welch, L.C. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003035.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

This paper describes a project to meet these data acquisition needs for a new accelerator, ATLAS, being built at Argonne National Laboratory. ATLAS is a heavy-ion linear superconducting accelerator providing beam energies up to 25 MeV/A with a relative spread in beam energy as good as .0001 and a time spread of less than 100 psec. Details about the hardware front end, command language, data structure, and the flow of event treatment are covered.

5144 (CONF-8410172—3) Operating experience and construction status of ATLAS. Pardo, R.C.; DenHartog, P.; Shepard, K.W.; Zinkann, G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002741.

From Symposium of northeastern accelerator personnel; Stony Brook, NY, USA (15 Oct 1984).

The present Argonne Tandem-Linac accelerator has operated in a reliable manner during the past year. The accelerator system provided 4402 hours of experimental beam time with a wide variety of heavy-ions. Figure 1 shows the beams which have been provided during the past year. New beams accelerated by the linac include 300 MeV ^{82}Se and 390 MeV ^{109}Ag. In tests, the tandem accelerated 102 MeV ^{127}I. This is the heaviest beam ever accelerated by the Argonne tandem. The long-term performance of the niobium resonators appears to be good. No significant degradation of performance has been observed for most resonators over many years of use with the exceptions of problems caused by catastrophic vacuum accidents. Resonators whose performance has deteriorated after vacuum accidents have recently been restored to their original performance state by a simple technique. The technique used is to rinse the interior of the resonator with a sequence of baths of solvents and water.

5145 (DOE/SF/00515—T40) Stanford Linear Accelerator Center monthly report for October 1984. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002852.

Operational activities for the month of October 1984 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

5146 (FEI—1498) Some technological aspects of manufacturing accelerating tubes. Ivanov, V.V.; Romanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703266.

Some improvements in the technology of manufacturing accelerating tubes (AT) are outlined which are aimed at increasing the electric strength of the accelerating gaps and ensuring the least spread in this parameter. As a result of applying an improved process of manufacturing using glass ceramic rings 24x180x230 mm in size and stainless steel electrodes with total area of 360 cm^3 the maximum withstood voltage of 70-75 kV with dark current less than $1x10^{-8}$ A has been obtained in accelerating gaps.

5147 (IAE—3640/15) Measurement and calculation complex for experiments at cyclotron. Vinogradov, A.A.; Paramonov, V.V.; Solov'ev, V.A.; Trunov, A.G.; Tsvetkov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703299.

Measurement and calculation complex intended for data acquisition, accumulation and processing in real time obtained in experiments in isochronous cyclotron is described. Two EC-1010 computers and the CAMAC equipment make up the basis of the sytem. Specially developed graphic display device is used for representation of one-dimensional and two-dimensional spectra and their marking. Identification of charged particles is realized using digital method by measuring specific energy losses on ionization in a transmission detector and particle energies in a detector of total absorption. Neutrons and gamma quanta are identified by the form of scintillation counter pulses using analog or digital methods. Two-year experience of the complex using in experiments has revealed rather high universality of the developed means, large variety of service capabilities, anfdd high detection efficiency in the whole range of real pulse measuring circuit loadings.

5148 (INS-NUMA—50) Characteristics of sextupole magnets for TARN. Noda, A.; Kadota, S.; Takanaka, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Apr 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703271.

A correction system of chromaticities with use of sextupole magnets has been installed in TARN. Twelve magnets are divided into two families, SF and SD, which locate places with different twiss parameters to adjust chromaticities in horizontal and vertical directions indepent on each other. The sextupole magnet can excite the integrated sextupole strength (B"ds) of 66 kG/m for the excitation current of 400 A to attain enough chromaticity size for N^{6+} with kinetic energy of 8.55 MeV/u. With the sextupole system, working line nearly parallel to the difference resonance νsub(x) - νsub(z) = 0 has been realized. The chromaticities for this working line calculated by an analytical method with use of sextupole strength are -2.48 and -2.27 for horizontal and vertical directions, respectively, which are quite in good agreement with experimentary measured ones of -2.47 and -2.23.

5149 (INS-TH—152) Microcomputer-aided monitor for liquid hydrogen target system. Kitami, T.; Watanabe, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703274.

A microcomputer-aided monitor for a liquid hydrogen target system has been designed and tested. Various kinds of input data such as temperature, pressure, vacuum, etc. are scanned in a given time interval. Variation with time in any four items can be displayed on CRT and, if neccessary, printed out on a sheet of recording paper.

5150 (Juel-Spez—255, pp 144) **Target laboratory.** Pfeiffer, J.; Riepe, G. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5151 (Juel-Spez—255, pp 153) **Composition of the radioactive contaminations at JULIC and sensitivity of the contamination measuring devices.** Uray, I.; Probst, H.J. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5152 (Juel-Spez—255, pp 155) **Gamma-neutron radiation field in the cyclotron vault.** Uray, I.; Probst, H.J. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5153 (KEK—82-1, pp 621-652) **SLAC future plans.** Ballam, J. (Stanford Linear Accelerator Center, CA (USA)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The future of the stanford Linear Accelerator Center lies mainly in the SLAC Linear Collider (SLC) which is a modified version of colliding linear accelerators operating at 100 GeV in the center-of-mass with the option of e^+e^- collision or e^-e^- collision. A proposal for such an accelerator to be located in the SLAC site was submitted to the Department of Energy, U.S.A. Its estimated cost is 87 million dollars, and the construction period is about three years. The earliest completion date would be November, 1986. The SLC project has two main goals, namely to study the physics in the Z^0 region and to study beam-beam interaction of single bunches of extremely high charge density in order to provide the specifications for a 1 TeV collider. The scaling laws for a storage ring and a colliding linac are described, and the cost of 350 x 350 machines was compared. The luminosity of both types is similar. Beam and wall interaction, longitudinal wake field, transverse wake field, quantum effect in arc transport, disruption parameter, the energy dependence of luminosity and longitudinal polarization in the SLC are described. The SLC has the unique features for physics measurement, and the research and development program is shown.

5154 (KEK—82-1, pp 682-689) **Data acquisition and readout electronics.** Karita, Yukio (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

5155 (KEK—82-3, pp 1-5) **Vacuum system of GANIL.** Shimizu, Akira (Osaka Univ., Suita (Japan). Research Center for Nuclear Physics). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The erection of a ring cyclotron (also called separate sector cyclotron) is underway at GANIL (Grand Accelerateur National d'Ions Lourds) in France, in which the heavy ions ranging from carbon to uranium are accelerated up to about 100 MeV per nucleon for lighter nuclides and up to 10 MeV per nucleon for heavier nuclides. It is slightly different from the project of the Institute of Physical and Chemical Research in Japan in cyclotron configuration and vacuum chamber structure. The ions accelerated with a rather small cyclotron of $K = 30$ as the injector (maximum accelerating energy per nucleon E is given by $E/A = K\,(q/A)^2$, where A: mass number of accelerated particle, and q: number of ion charges), are accelerated fully in two succeeding ring cyclotrons of $K = 400$ (injecting radius 80 cm, extracting radius 300 cm). Evacuation system is designed aiming at 5×10^{-8} Torr after 25 h evacuation and at 2×10^{-8} Torr 100 hours after starting evacuation. The treatment of the accelerator and beam transports such as baking and discharge cleaning is not planned. Vacuum chambers and cryo-pumps for these ring cyclotrons are reported in detail for their construction and evacuation. In the autumn of 1981, magnetic field measurement was underway in one vacuum chamber, and leak test in the other chamber. The vacuum of 5×10^{-8} Torr was obtained by driving six cryo-pumps out of eight planned. Finally, the interim report on the evacuation test of vacuum chambers is introduced.

5156 (KEK—82-3, pp 6-13) **Vacuum system of the separated sector cyclotron in the Institute of Physical and Chemical Research.** Nakajima, Junji; Ikegami, Kumio; Oikawa, Yoshio; Takeshita, Isao (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The titled SSC which is under construction was planned as the second stage of a complex accelerator, whose first stage is a heavy ion linear accelerator or AVF cyclotron. Its target energy is expressed as $E = 540\,(q/A)^2$, where A is mass number, and q is number of valences. The major specifications and the planar layout are shown. At present, the acceleration chamber and its evacuation system are being designed. The objective pressure is below 1×10^{-7} mm Hg or in the order of 10^{-8} mm Hg. Considering the associated devices and the ease of adjustment and repair, the acceleration chamber is composed of separately manufactured four magnet sections, two RF resonator sections, two pump mounting sections which are the main bodies (called "valley"), jointed with flanges between adjacent sections. Since the distance between magnets and resonators is very small, bolts and nuts can not be used, but the pneumatically actuated expansion seals are employed. It is desired that the evacuation system is the one which can reach the objective pressure within 20 hours after start-up. If the outgassing from the equipment in the acceleration chamber and the permeation through the gaskets are taken into account, the pump whose effective evacuation rate is 11×10^4 l/s or more will be required. It is scheduled to install two 25,000 l/s cryo-pumps and one turbo-molecular pump of 2,000 l/s to the "valley", one 10,000 l/s cryo-pump and one 5,000 l/s turbo-molecular pump to each R.F. resonator, and each two 3,000 l/s cryo-pumps to every four gaps between magnets and resonators.

5157 (KEK—82-3, pp 14-22) **Pneumatic-expansion-seal-model testing for the separate sector cyclotron in the Institute of Physical and Chemical Research.** Ikegami, Kumio; Nakajima, Junji; Oikawa, Yoshio; Takeshita, Isao (Institute of Physical and Chemical Research, Wako, Saitama (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The vacuum chamber of the separate sector cyclotron (SSC) which is under erection at the Institute of Physical and Chemical Research is divided into eight sections. An important problem for the split vacuum chambers is vacuum seal between two chambers. It was decided to use the pneumatic expansion seal as a method to be capable of easily assembling and disassembling the chambers. This seal is two thin stainless steel sheets cut out in the form of race track and welded along their inner and outer circumferences. Its size is about 3.5 m x 1.5 m. It is sandwiched between two flanges, in the O-ring grooves or seal guides of which O-rings are placed. The vacuum seal is realized by expanding the seal with compressed air, and pressing O-rings to the flanges. For this purpose, three 1/3 size models, different in the seal width and thickness, have been fabricated and tested. Even if the applied pressure was decreased gradually, the seal did not return to its condition before pressurizing, and the deformation remained at the straight portion. When the pressure was reduced below atmospheric pressure, the seal restored to its initial condition. The result of leak test showed that the seal did not cause leakage if the expanding and contracting range was within 20 mm at the vacuum of 10^{-5} Torr or less. It is concluded that the seal can work in a considerable expanding and contracting range without leak, but it seems appropri-

ate to be pressurized with 1 kg/cm^2 or less if the stress measurement results are considered.

5158 (KEK—82-3, pp 23-31) **Project of 1.2 GeV electron linac in the Tohoku University.** Konno, Osamu (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

In the titled project, its construction is scheduled for 4 years starting in the fiscal year of 1983. The top-most feature is to obtain 100 % duty factor by combining a pulsed electron linac with a pulsed beam stretcher. That is, the attempt is to form electron beam analogous to D.C. and to make coincidence available. As a system to obtain this electron beam analogous to D.C., the stretcher system is employed, in which the beam of pulsed electron linac is completely injected into the ring, then taken out little by little at 100 % efficiency and at average intensity until the next pulse occurs. The vacuum manifold system is adopted as an evacuation system of accelerating tubes. The accelerator is located in the position of 13.5 m underground, and the synchrotron radiation experiment room (SOR) and neutron diffraction experimental room are placed on the ground. The SOR is installed in the upstairs of the pulse stretcher ring. For the pulsed beam stretcher system, it is planned that 16 sets of 320 l/s ion pumps for holding vacuum, 4 sets of 450 l/s turbo-molecular pumps for rough extraction system, and 4 sets of 320 l/s ion pumps for differential evacuation system, should be provided if the target pressure is 1 x 10^{-8} Torr. Since there are many items to be investigated for the SOR, only the ring radius has been decided so far to be 14.66 m x 15.60 m.

5159 (KEK—82-3, pp 42-46) **Design of UVSOR vacuum system in the Institue for Molecular Science.** Sakai, Kusuo; Watanabe, Makoto (Institute for Molecular Science, Okazaki, Aichi (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

In the Institute for Molecular Science, super ultraviolet radiation experimental facility (UVSOR) is presently erected. The UVSOR vacuum system is roughly divided into a linear accelerator (1 x 10^{-8} Torr), a synchrotron (1 x 10^{-6} Torr), an electron storage ring (1 x 10^{-9} Torr), and observation system (1 x 10^{-8} Torr). The electron gun assembly of the linear accelerator requires vacuum of 1 x 10^{-9} Torr. In the UVSOR, the incident electrons are accelerated up to 600 MeV in 0.15 seconds. For this purpose, the doughnut is made into the bellows formed with stainless steel of 0.3 mm thick to prevent eddy current. To obtain vacuum of 1 x 10^{-6} Torr without baking, a 140 to 160 l/s noble pump and a 1000 l/s Ti sublimation pump are installed in each straight part. The RF cavity is a cylinder of 1 m diameter and 40 cm length, the inside being made of copper. The target value of storage current in the storage ring is 500 mA. The vacuum required at 500 mA beam loading is 1 x 10^{-9} Torr or less. A 250 l/s built-in pump is installed in each deflector, and further a 400 l/s ion pump and a 1000 l/s sublimation pump are at the deflector outlet for evacuation. It is important to obtain better vacuum for the observation system, not only to avoid adverse effect on storage ring vacuum but also to prevent optical elements from being contaminated by SOR and in addition to experiment under superhigh vacuum.

5160 (KEK—82-3, pp 47-60) **Radiation damage status of and its counter-measures for the metal doughnut of electron synchrotron in the Institute of Nuclear Study, University of Tokyo.** Tsujikawa, Hiroshi; Yoshida, Katsuhide (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

Recently, as a result of being exposed to intense radiation estimated to be about 10^{11} rad, the local corrosion pits have frequently occurred in the metal doughnut of thin wall bellows made of stainless steel SUS 304 of 0.12 mm thickness in the electron synchrotron in the Institute of Nuclear Study. The status is considered to be that its life is over, and the examination of the causes and counter-measures are urgently required. The metal doughnut is presently in the period of cool-down of radioactivity. After that, it is scheduled to cut the test pieces from the damaged part, and to perform a series of analysis for the examination. In this report, the working conditions of the doughnut till it has been damaged and also the damage status viewed from outside are described in detail. The characteristic facts revealed by leak test were as follows: frequent damages have abruptly begun when the operating time exceeded 35,000 hours, and the damaged parts were almost the same within the range of 25 cm from the edge of the orbital magnet, specifically from the center to lower surface of the inner peripheral wall of the orbit or the valley part of the bellows. Degree of leakage was various, and the amount was in the range from 10^{-6} to 10^{-2} Torr.l/s and several tens of leakage points were adjacent to each other. As the cause of damage, stress corrosion cracking due to the exposure to electron beam deviating from the orbit in incident process is the most probable.

5161 (KEK—82-3, pp 106-112) **Baking of tandem accelerator tube by low voltage arc discharge.** Nakajima, Yutaka (Kyushu Univ., Fukuoka (Japan). Faculty of Science). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

In designing the accelerating tube for a static tandem accelerator in Kyushu University, the basic policy was as described below: individual unit composing the accelerating tube should fully withstand the electric field of 2 MV/m, and electric discharge must not be propagated from one unit to the adjacent unit when these are assembled to the accelerating tube. The accelerating tube units are each 25 cm in length, and both high and low energy sides are composed of 20 units, respectively. Although about 10^{-9} Torr vacuum was obtained at the both ends of the accelerating tube by baking the tube at 300 to 350 deg C with electric heaters wound outside the tube in the conventional method, vast outgas was generated, which decreased vacuum by two or three figures if breakdown occurred through the intermediary of outgas. As a method of positively outgassing and cleaning the electrodes inside the accelerating tube, it was attempted to directly bake all the electrodes in the accelerating tube by causing strong arc discharge flowing H_2 gas in the tube. As a result of considering the conditions for this method, the low voltage arc discharge was employed using oxide cathodes. Thus, after implementing 10A arc discharge for several hours, the voltage was able to be raised to 10 MV almost immediately after the vacuum recovery, and further, after another conditioning for several hours, it was successful to raise voltage up to 11 MV.

5162 (KEK—82-3, pp 163-168) **Outgassing from metal surface.** Mizuno, Hajime; Horikoshi, Gen-ichi (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The Freundlich type adsorption isotherm was investigated. The amount of out-gassing from samples was measured from the pressure difference of both sides of an orifice (the through-put method). The samples were two kinds of electroplating copper, oxygen free copper, stainless steel (SUS 304), and 6063 aluminum alloy. The amount of adsorption was measured by the thermal-desorption method. The results showed that the Freundlich type adsorption isotherm was able to be obtained for all samples. The amount of adsorption on the aluminum alloy was smaller than that on other samples. The amount of adsorption obtained by the thermal-desorption method was in agreement with the amount obtained from the adsorption isotherm. It can be said that the out-gassing from metal surface is the desorption of H_2O molecules determined by the Freundlich type adsorption isotherm.

5163 (KEK—82-5, pp 1-8) **Polarized H^- ion source at KEK.** Mori, Yoshiharu (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780078. (CONF-8009333—).

From 2. workshop on two nucleon system; Oho, Ibaraki, Japan (19 Sep 1980).

The polarized H^- ion source being developed at KEK is designed on the basis of the optical pumping. The charge exchange between H^+ ions and the Na atoms aligned by the optical pumping method is caused. The intensity of polarized H^- ions is about 10 μA for 1 mA of H^+ ion beam. The condition of optical pumping is studied for the D_1 line of Na atoms. By using a dye laser, it is possible to make the Na atoms with aligned electron spins. An experiment was designed to confirm this study. The experimental values of the electron spin polarization of Na atoms as a function of target thickness in a Na cell were measured. The polarization of 60 to 70 percent is observed. Theoretical discussion is given for this experimental result.

5164 (KEK—82-5, pp 9-23) **Acceleration of polarized beam by the accelerator at KEK (National Laboratory for High Energy Physics of Japan).** Hiramatsu, Shigenori (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780078. (CONF-8009333—).

From 2. workshop on two nucleon system; Oho, Ibaraki, Japan (19 Sep 1980).

The acceleration of polarized beam with the accelerator at KEK was investigated. The intrinsic spin resonance, which is caused by the precession, and the imperfection resonance due to the closed orbit distortion make the depolarization of beam. An equation of motion of spin in a magnetic field is presented to study the intensity of the depolarization resonance and the degree of depolarization. The fast resonance crossing and the slow resonance crossing were studied to make the depolarization minimum. It was found that the proton synchrotron of KEK was not suitable for the acceleration of polarized beam. The polarization will be kept by the spin-flip (slow resonance crossing). However, the precise study of the characteristics of the accelerator is required. The depolarization due to the imperfection resonance may be reduced to less than 20 percent for energy below 7 GeV.

5165 (KEK—82-5, pp 24-38) **Experiment by using polarized beam of ZGS.** Tamura, Akio (Kyoto Univ. (Japan). Faculty of Science). Jul 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780078. (CONF-8009333—).

From 2. workshop on two nucleon system; Oho, Ibaraki, Japan (19 Sep 1980).

Some of the experiment performed by using the polarized beam of ZGS are explained. Six beam lines were provided for the experiment with polarized beam. The polarized beam ion source was an atomic beam type ion source. The depolarization during the acceleration was limited to about 15 percent in terms of the maximum energy. A beam line system was installed to supply beam polarized to any direction. Four sets of polarimeters were provided. Polarized targets were also used for most of the experiment. The experiment performed was concerned with dibaryon resonance, the amplitude analysis of p-p scattering at high energy, parity violation, elastic scattering at high momentum, inclusive reactions, and inelastic scattering. The studies on some of these problems are now in progress at other institutes.

5166 (KEK—82-5, pp 39-45) **Spin parameters and partial wave analysis.** Hoshizaki, Norio (Kyoto Univ. (Japan). Faculty of Engineering). Jul 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780078. (CONF-8009333—).

From 2. workshop on two nucleon system; Oho, Ibaraki, Japan (19 Sep 1980).

The problems concerning the experiment using polarized proton beam and polarized targets are discussed. The problems to be studied are the origin of repulsive core in nuclear force, the relation between one boson exchange model in low energy scattering and Regge model in high energy scattering, di-baryon, and the spin effect in p-p scattering with large momenta. The spin-spin parameters in nucleon-nucleon scattering should be measured for the study of above mentioned problems. The studies of reaction process may be important. The partial wave analysis of p-p scattering experiment has been made, and the information on di-baryon has been accumulated. The resonance of the singlet D_3 and that of the triplet F_3 were precisely studied. Other resonances were also reported. The analysis of n-p scattering was made, and a negative parity resonance was suggested.

5167 (KEK—82-5, pp 83-88) **What kind of experiment can be done with the KEK polarized beam.** Nakanishi, Wataru; Horikawa, Naoaki (Nagoya Univ. (Japan). Faculty of Science). Jul 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780078. (CONF-8009333—).

From 2. workshop on two nucleon system; Oho, Ibaraki, Japan (19 Sep 1980).

Among various experiments to be done at KEK (National Laboratory of High Energy Physics), the polarization phenomena at high momentum are described. The spin correlation parameters of elastic nucleon-nucleon scattering were predicted from the constituent interchange model and the quark-quark scattering model. The results were compared with the experimental results. To clarify the discrepancy between the experimental results and the prediction, some experiment at KEK was suggested. The spin asymmetry in the inclusive process of polarization experiment was measured. The hard scattering model was proposed to explain the measurement. The accumulation of experimental data is not sufficient.

5168 **(LBL—17996) Continuous liquid sheet generator for ion stripping.** Gavin, B.; Batson, P.; Leemann, B.; Rude, B. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002886.

Many of the technical problems of generating a large thin liquid sheet from 0.02 to 0.20 μm thick (3 to 40 $\mu gm/cm^2$) have been solved. It is shown that this perennial sheet is stable and consonant in dimension. Several ion beam species from the SuperHILAC have been used for evaluation; at 0.11 MeV/n. In one of three modes this sheet serves as an equivalent substitute for a carbon foil. The second mode is characterized by a solid-like charge state distribution but with a varying fraction of unstripped ions. The third mode gives stripping performance akin to a vapor stripping medium. 9 references, 7 figures.

5169 **(NIIEFA-P-F—0585) Integral coefficients of reflection for the electron beam scattered in a foil and air from semi-infinite absorbers.** Afanas'ev, M.I. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703268.

With the purpose to determine the corrections for electron backscattering introduced when measuring the current and power characteristics of the radiation field of the electron accelerator with a scanned beam by the method of total or partial absorption, the integral reflection coefficients are calculated by the Monte-Carlo method. The reflection of the electron beam passed through the accelerator convex Al or Ti foil 50 μm thick and the layer of air 50, 100 and 150 mm thick from the semi-infinite C and Fe absorbers is considered in the 48-160 phiJ energy range. The relations between integral coefficients of reflection from the C, Al, Ti, Cu absorbers are experimentally determined. On the base of the obtained data analysis the conclusion is drawn that integral reflection coefficients are independent on the air layer thickness.

5170 **(RAL—84-015) Advanced spallation neutron sources for condensed matter research.** Lovesey, S.W.; Stirling, G.C. (Rutherford Appleton Lab., Chilton (UK)). Mar 1984. 14p. (CONF-8403122—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703270.

From 4. general CMD conference of the condensed matter division of the European Physical Society; Hague, Netherlands (19 Mar 1984).

Advanced spallation neutron sources afford significant advantages over existing high flux reactors. The effective flux is much

greater than that currently available with reactor sources. A tenfold increase in neutron flux will be a major benefit to a wide range of condensed matter studies, and it will realise important experiments that are marginal at reactor sources. Moreover, the high intensity of epithermal neutrons open new vistas in studies of electronic states and molecular vibrations.

5171 **(RAL—84-031) Spallation neutron source RF cavity bias system.** Culliford, D.R. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 32p. (SNS—0-N1-84). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703273.

The Spallation Neutron Source r.f. cavity bias system is described under the topic headings: bias system, r.f. cavity, cables, d.c. bias power supply, transistor regulator and control system. Calculation of 4 core 300 mm solid aluminium cable inductance, coaxial shunt frequency response and transistor regulator computed frequency response, are discussed in appendices 1-3.

5172 **(UCRL—91041) Ion source development at RTNS-II.** Massoletti, D.; Heikkinen, D.W. (Lawrence Livermore National Lab., CA (USA)). 26 Sep 1984. Contract W-7405-ENG-48. 14p. (CONF-841117—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003138.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Results are reported for an ongoing effort to optimize D^+ beam production by the MATS-III ion source used at RTNS-II. The characteristics of the source have been determined. Particular attention was paid to the extraction geometry and plasma production. The plasma spatial and temporal uniformity has been examined. The seven aperture triode geometry has been varied to optimize neutron production. This includes beamlet steering and electrode gapping as well as aperture shaping. 4 references, 4 figures.

5173 **Variable aperture collimator for high energy radiation.** Hill, R.A. (to Dept. of Energy). US Patent 4,450,578. 22 May 1984. Filed date 3 Mar 1982. vp.

PAT-APPL-354552.

An apparatus is disclosed providing a variable aperture energy beam collimator. A plurality of beam opaque blocks are in sliding interface edge contact to form a variable aperture. The blocks may be offset at the apex angle to provide a non-equilateral aperture. A plurality of collimator block assemblies may be employed for providing a channel defining a collimated beam. Adjacent assemblies are inverted front-to-back with respect to one another for preventing noncollimated energy from emerging from the apparatus. An adjustment mechanism comprises a cable attached to at least one block and a hand wheel mechanism for operating the cable. The blocks are supported by guide rods engaging slide brackets on the blocks. The guide rods are pivotally connected at each end to intermediate actuators supported on rotatable shafts to change the shape of the aperture. A divergent collimated beam may be obtained by adjusting the apertures of adjacent stages to be unequal.

4304 Storage Rings

REFER ALSO TO CITATION(S) 4304005137, 5159

5174 **(DESY-L-Trans—290) Possibiblity to obtain longitudinal particle polarization in the collider VEPP-4.** Nikitin, S.A.; Saldin, E.L. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750018.

A new design to obtain longitudinal polarization of particles in the collider VEPP-4 by means of a superconducting solenoid turning the spin around velocity about the angle of π ("Sibirian coil winder" of the first type) has been calculated. The problem was solved to compensate the perturbation introduced by a solenoid in orbital motion. The analysis of radiation kinetics of the spin proves that the time of depolarization in the region of 2 GeV may amount to several hours. We discuss a method for injecting the polarized beam from a booster collider VEPP-3 to the collider VEPP-4.

5175 (KEK—82-1, pp 1-23) **Over-view of the TRISTAN accelerator project.** Nishikawa, Tetsuji (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

In 1973, the TRISTAN (Transposable Ring Intersecting Storage Accelerators in Nippon) project was proposed. The construction plan started in 1981. The whole TRISTAN project includes the construction of a large storage ring complex which aims at various colliding beam experiments at very high center-of-mass energy. It has the capability to accelerate electrons or positrons up to 25 to 30 GeV and protons to more than 300 GeV. The entire TRISTAN project is divided into the phase 1 and the phase 2. In the phase 1, the electron ring is constructed with the whole accelerator enclosure. The phase 1 aims at search for new particles. The construction of TRISTAN began in April, 1981, and is scheduled to be completed in mid-1986. The electron accumulating ring is designed to work as a storage ring up to 6.5 GeV so that it can be used for e^+e^- colliding beam experiments at the upsilon energy-range. The values of the maximum luminosity for e^+e^- collision at the main ring are 3×10^{31} and $9 \times 10^{31}/cm^2.s$ corresponding to the long experimental insertion case and the low-β case, respectively. Special attentions are paid for the engineering and technical developments.

5176 (KEK—82-1, pp 24-77) **Status report of the accelerator design and construction.** Kimura, Y. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The accelerator design of TRISTAN project is described. A basic consideration for designing the main e^+e^- colliding ring of TRISTAN is how to increase the technically achievable energy with its limited dimensions of about 1 km x 1 km. It is necessary to compensate for the synchrotron radiation loss. The ring has four long straight sections connected by curved sections. Each long straight section has a detector at the middle and RF cavities in the rest of the straight section. The mean radius of the curved section is 340 m, and the bending radius is 250 m. A 2.5 GeV linear accelerator will be used as an injector of electron and positron beams. An intermediate accumulating ring is introduced between the linac and the main ring to overcome some problems. The accumulating ring is designed to have a radiation damping time of about 20 msec at 2.5 GeV corresponding to a repetition rate of the injector linac of 50 Hz. The energy of beams transferred to the main ring is chosen to be 8 GeV. As a future option, a proton ring can be constructed in the main ring tunnel. The main electron linac is designed to accelerate 50 mA electron beam of 1 micro sec pulse width or 500 mA beam of 2 ns pulse width. An energy compression system is added. The accumulating ring is also designed to function as an independent electron-positron storage ring for colliding beam experiments. The design and technical features of accelerators, magnets, RF system, vacuum system, beam monitors, beam transport and control system are described.

5177 (KEK—82-1, pp 89-93) **Report on TRISTAN meeting at Santa Barbara.** Lynch, H.L. (California Univ., Santa Barbara (USA)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

5178 (KEK—82-1, pp 94-116) **4 magnetic spectrometer for TRISTAN.** Iwata, Seigi (Nagoya Univ. (Japan). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

We propose a 4π magnetic spectrometer as a universal detector at TRISTAN E^+E^- collider. A part of the simulated per-

formance is reported here; the detection of hadronic one-photon-annihilation events and the search of the fundamental scalar particle.

5179 (KEK—82-1, pp 117-185) **'Water ball' for TRISTAN.** Koshiba, M.; Sato, A.; Totsuka, Y.; Watanabe, Y. (Tokyo Univ. (Japan). Faculty of Science). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

A water ball detector is proposed for the E^+E^- collider TRISTAN. It consists of an 10 m radius sphere filled with pure water and 2 m radius tracking chamber either nonmagnetic or magnetic. The water ball is used as photon, electron and hadron calorimeter as well as muon-identifier. The inner tracking chamber is used to measure the directions of the emitted charged particles. With the application of magnetic field, the detector becomes a universal detector. We report here the preliminary design, its expected response to individual particles, and its expected physics performance.

5180 (KEK—82-1, pp 267-289) **Compact BGO detector for TRISTAN.** Ikeda, Hirokazu; Kobayashi, Masaaki; Kurokawa, Shin-ichi (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

Performance of BGO-bar crystal is briefly described including the optical properties, the energy resolution and the uniformity. BGO-bar is highly resistive to radiation damage, proving that it is ideal to be used in high energy E^+E^- storage ring detectors. After briefly discussing the BGO-bar detectors for LEP and CESR II, a "BGO-bar Ball" is proposed for a compact detector primarily dedicated to Higgs search at TRISTAN. If a hadron calorimeter is added outside the "BGO-bar Ball", the other important physics including accurate measurement of R and top quark searches through jet analyses will be possible.

5181 (KEK—82-1, pp 290-294) **Toroidal field magnetized iron with TOF counters for detecting highly penetrable charged particles.** Ohsugi, T.; Endo, I.; Kawamoto, T.; Takeshita, T. (Hiroshima Univ. (Japan). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

5182 (KEK—82-1, pp 295-310) **Possible particle searches at TRISTAN: the Higgs boson and its relatives.** Sakai, N. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

We review exciting possibilities offered by Tristan to search for the Higgs boson and its relatives. The neutral Higgs boson in the minimal SU(2) x U(1) model and charged Higgs bosons in non-minimal models are briefly discussed. We emphasize the motivation for more ambitious models -- requirement of naturalness of gauge hierarchy leads to either technicolor models or supersymmetric models. Signatures of these models at Tristan are also summarized.

5183 (KEK—82-1, pp 311-336) **CELLO detector and LAr calorimeters at PETRA.** Fluegge, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The layout and performance of the CELLO detector at PETRA is described. In particular, its LAR calorimeter is presented in comparison with the TASSO shower detector. First experience with longterm stability and performance of LAr calorimeters at PETRA is discussed.

5184 (KEK—82-1, pp 441-465) **Cylindrical drift-chamber of the TASSO-experiment at PETRA.** Boerner, H. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The design of the large cylindrical drift-chamber of the TASSO-detector at PETRA is described. A summary of the experience gained in the three years of operation is given. An outstanding feature is the high reliability of the driftchamber system. So far a spatial resolution of omicron = 200 μm has been achieved. The momentum resolution was measured with cosmic ray tracks, μ-pairs and Bhabha-events, consistently yielding a value of dpsub(t)/psub(t) = 1.4 % psub(t) (psub(t) in GeV/c). The errors in the track parameters are in good areement with the predictions of a MC-simulation. Finally, suggestions for future improvements are made.

5185 (KEK—82-1, pp 690-695) **Report of subgroup on new ideas for instrumentation.** Ohsima, T.; Okuno, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

5186 (KEK—82-1, pp 696-702) **R measurements at TRISTAN.** Bensinger, J.R. (Brandeis Univ., Waltham, MA (USA). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

5187 (KEK—82-1, pp 78-88) **Report of experimental hall subworking group.** Miyake, K.; Ohama, T.; Takahashi, K. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The general plan of constructing the TRISTAN e^+e^- colliding beam experimental halls may be divided into two parts. The first step is to construct two test-experimental halls associated with the 6.5 GeV x 6.5 GeV e^+e^- accumulator ring, and the second step is to build four experimental halls at the 30 GeV x 30 GeV e^+e^- TRISTAN main ring. At this workshop, extensive discussions on the detailed design of the four main ring experimental halls have been made. Four experimental areas will be built at the main ring, and two test-experimental halls at the accumulating ring. Among the four areas at the main ring, two will be used for electron-proton possible as well as electron-positron colliding beam experiment. The other two will be used exclusively for e^+e^- colliding experiments. Only a preliminary design has been made for these four experimental areas. A tentative plan of a larger experimental hall includes a counting and data processing room, a utility room, and a radiation safety control room. Two smaller halls have simpler structure. The figures of the experimental halls are presented. The two test-experimental halls at the accumulator ring will be used to test the detectors for e^+e^- colliding experiments before the final installation. The utility rooms designed for the halls are used to supply coolant and electric power of superconducting magnets. At the workshop, various ideas concerning the preliminary plan are presented.

5188 (KEK—82-1, pp 211-226) **Pattern recognition in classical type tracking chambers at TRISTAN.** Suzuki, A. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The pattern recognition methods of the MARK-2 and CLEO chambers and the results of Monte-Carlo simulation for this type of chambers are presented. Five parameters are used for the

description of helical tracks, azimuthal angle at the interaction point, impact parameter, a half of track curvature, z-coordinate of emission point and polar emission angle. The track reconstruction efficiency was calculated as a function of the magnetic field, the space resolution of the drift chamber, and the transverse momentum of generated tracks. The reconstruction efficiency was above 90 % for the 5K gauss field, the space resolution of 0.2 mm and 90 % chamber efficiency, and was weakly dependent of on the space resolution of the drift chamber. This track finding method has the difficulty in low momentum spiraling tracks and in the tracks going forward and backward along the beam. The present method was applied to the tracking chamber at TRISTAN energy. The results give the possibility of using this technique not only for finding track candidates, but also for the elimination of the wrong combination from the left-right ambiguity of the tracking chambers. In conclusion, it is convinced that a combination of the global pattern recognition technique and the track following method provides an effective way for pattern recognition in central tracking chambers.

5189 (KEK—82-1, pp 227-234) **Status report of data acquisition.** Endo, Ichita (Hiroshima Univ. (Japan). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The data acquisition system for the experiment with TRISTAN at KEK is discussed. For the standardization of the data bus, CAMAC-based system with possible improvement and FASTBUS being proposed by the US NIM committee were considered. The CAMAC has the disadvantages in the card size and the connectors. The card size is too small to house an intelligent circuit on a single board. The connectors cause most of troubles during the experiment. The FASTBUS is quite attractive from the viewpoint of the flexibility in bus speed and device size, although there is no commercially available FASTBUS device yet. It is not likely that other new data bus than CAMAC and FASTBUS is adopted by KEK for TRISTAN experiment. With respect to a standard microprocessor, an MC68000 (16 bit) has been picked up. The following items are being prepared by KEK to give support to users: i) the cross software of the MC68000 on the M200 H or PDP11, ii) the interface board for a personal computer equipped with a MC68000 chip to the FASTBUS and iii) a single board microprocessor module to be inserted in a FASTBUS crate. As for a host computer, a 32 bit minicomputer will be selected in 1982.

5190 (KEK—82-1, pp 235-250) **Universal detector with a dE/dx measurement.** Kondo, Takahiko (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

A universal detector for the 60 GeV e^+e^- colliding beam TRISTAN was proposed. The electron identification, which is important in QED, flavor physics, heavy leptons and deep inelastic esup(r) scattering for photon structure functions, should be carried out by a combination of two or three independent ways: a combination of a dE/dx drift chamber and an array of Pb-glass shower counters, and a dE/dx drift chamber plus a liquid argon counter system. A high pressure drift chamber, such as a new Mark 2 vertex detector, is sufficient to do the above-mentioned physics. For the dE/dx drift chamber, a jet chamber is considered. If more than 3 standard deviations are required in e/π separation at the momentum of 3 GeV/c, the radius of the jet chamber will be 2 meters. Although the large diameter results in a large magnet coil, a large shower counter, more TOF counters and so on, these disadvantages will be compensated by the better TOF resolution and the smaller probability of particle overlap in shower counters. Considering many difficult hardware and operational problems, the difference in e/π separability does not appear between 1 and 10 atom of the gas pressure in the chamber, accordingly, atmospheric pressure was chosen as the gas pressure for the simplicity of the mechanical construction. Finally, the momentum resolution of the drift chamber was calculated with 200 cm in outer radius and 5 kG magnetic field, and it was found to be more than enough. All parameters for this design are listed.

5191 (KEK—82-1, pp 251-266) **Detector design study, 6.** Mori, S. (Tsukuba Univ., Sakura, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

A major, general purpose detector for TRISTAN was designed to detect top quark, Higgs particles, heavy leptons, heavier quarks and so on. The present design is based on a CDF detector. A superconducting solenoid magnet similar to a CDF magnet provides about 1 Tesla magnetic field. A 1 m long and 1 m diameter superconducting solenoid magnet was built and tested to study the feasibility of constructing this magnet. The central calorimeter consists of 4800 lead glass electromagnetic detectors, which covers about 80 % of the total solid angle. The lead glass counters have been chosen to get the best energy resolution for the detection of monochromatic gamma from the decay of a t anti-t state associated with a Higgs particle. For the end cap electromagnetic calorimeter, a lead-PWC sampling calorimeter of the CDF type was proposed, and if necessary, it will be replaced by a lead-liquid argon calorimeter with a better energy resolution, which requires more resources. Longitudinal segmentation and the information on radial shower distribution are required for the separation of electrons from hadrons. A MARK 2/TASSO/CLEO- type cylindrical drift chamber was proposed for the central tracking chamber. The cell width of the chamber should be about 32 mm x (40/60) x (12/15) = 17.1 mm in order to keep the same hit rate as the TASSO chamber. For the data acquisition system and electronics, a CAMAC system will be used.

5192 (KEK—82-1, pp 337-371) **High resolution spectrometer.** Derrick, M. (Argonne National Lab., IL (USA)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The design and construction of a high resolution spectrometer is described. After its approval, the following decisions were made: to lengthen the magnet along the field direction, to incorporate a series of proportional tubes in the shower counter system to measure the γ-ray conversion point, and to make a very thin outer drift chamber. The detector is kept as clean as possible by minimizing the amount of material in the inner detector. The inner layer of the barrel shower counter is used for TOF measurement, and the endcap counters are arranged to move axially. A muon system, which consists of 10 cm square tubes in two layers, has been designed. A Cherenkov counter system is placed between the inner and outer drift chambers to some kind of particle identification system. In designing the detector elements, small prototypes were built and tested during 1980. The Cherenkov counter system will be installed in summer 1982. Other aspects in these design and construction; i.e., software, electronics, trigger system, luminosity monitor, magnet and detector monitoring are discussed. Finally, the lessons which were obtained during the construction of the spectrometer are presented.

5193 (KEK—82-1, pp 372-440) **Status report of PEP-4.** Kamae, Tuneyoshi (Tokyo Univ. (Japan). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The present status of PEP-4 is reported. The cosmic ray test of a TPC without magnetic field was done in July, 1981, and tracks were observed on the first day of the test. The entire PEP-4 detector was tested with 3.9 kG magnetic field in November, 1981, and various trigger configurations were tested. The TPC performed well during the test, and a preliminary analysis gave an encouraging position resolution which is expected to be improved with the correction for various non-uniformity and by refining the fitting procedure. Furthermore, the detection efficiency of the muon chamber was about 99 %. In November and December, 1981, the cosmic ray test of the hexagonal calorimeter was carried out. The performance was just as expected. Noise did not pose any problem, and the peak of the Fourier coefficient gave a nice overall calibration of the calorimeter. There are some problems to be solved in

future. With the TPC, the impurities in the gas, the electronic noise, the hooks and the magnetic coil should be improved. In addition, there are some problems with the inner drift chamber, the hexagonal calorimeter and the relativistic rise measured by the TPC. The very recent results with the first e^+e^- beam obtained in February, 1982, are briefly reported, although the events have not been fully analyzed.

5194 (KEK—82-1, pp 466-495) **Some ideas on a central tracking chamber for the SLAC linear collider.** Seiden, Abraham (California Univ., Santa Cruz (USA)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

First, the constraint imposed on the design of a central tracking device by the energy and event characteristics at the Z^0 is discussed. The requirement for momentum resolution ($\Delta p/p^2 = f$) in various measurements is considered, for example, muon asymmetry, tau polarization measurement, particle invariant masses and lepton momenta. A Chamber of f = 0.1 %, which is on the basis of the above-mentioned measurement, requires outer radius of 1.75 m, magnetic field of 10 kG and 45 wire layers. Second, a specific design of an axial chamber with moderately large drift cells is discussed. The segmentation requirements for track finding is considered in terms of "confusion distance". The characteristics of the multi-wire cells are described, and the distribution of collected electrons from two normal incident tracks is calculated. The advantage of the cells is that the left-right ambiguity in an individual cell is resolved before pattern recognition, which is very useful in an environment containing many soft photons and neutrons. The current-division technique which is useful for measuring the z-coordinate and dip angle for tracks in a chamber is described. Several problems are discussed about this technique, by which the position along a wire by measuring the charge collected on both ends of the wire with a low impedance amplifier is determined. Finally, the pattern recognition is discussed briefly. The advantages of a multi-wire cell for finding tracks are pointed out.

5195 (KEK—82-1, pp 496-510) **Modified magnetic calorimeter.** Loh, E.C. (Utah Univ., Salt Lake City (USA). Dept. of Physics). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The modification and the practical use of a magnetic calorimeter detector (MAC) for the TRISTAN experiment are discussed. As for the central drift chamber, the radius of 50 cm is kept, the identification of "wrong sign" $\mu^+\mu^-$ or e^+e^- is scarcely required, and the solenoidal field is increased to the design limit, 10 kG. The spatial resolution will be about 100 μm, and a factor of 5 or 10 in the spatial resolution will be obtained by using additional field wires. The entire central drift chamber can be replaced by a TPC which has the additional advantage of dE/dx and particle identification capabilities. For the electromagnetic calorimeter, about 10^4 crystals of bismuth germanate ($Bi_4Ge3012$ = BGO), of which the energy resolution was proven to attain a few MeV, are used. A preamplifier, a shaping amplifier and a logarithmic amplifier are attached to each crystal. The BGO shell is about 30 cm thick. The new solenoid coil made of copper or aluminum has an 80 cm inside radius. The hadron calorimeter is used with minor repair and some electronics upgrade. As for the muon drift system, the momentum resolution is estimated to be 0.3 at 30 GeV. A number of physics objectives for e^+e^- annihilation at TRISTAN energy with the practical use of the proposed detector are summarized: i) the calorimetry experiments including R measurement near the Z^0 pole, jet studies, μ^{+-} charge asymmetry, e^{+-} charge asymmetry, μ^{+-} and e^{+-} inclusive spectra, and quark flavor tagging, ii) the precise γ or e^{+-} energy measurement including $e^+e^- \rightarrow \gamma$ anti-ν near the Z^0 pole, γ (t anti-t) + H, and toponium studies, iii) the lifetime measurement of a 15 GeV tau, and the hadron identification and inclusive spectra.

5196 (KEK—82-1, pp 560-572) **Physics and experience with a forward angle spectrometer at e^+e^- colliding beam machine.** Williams, Crispin; Maeshima, Kaori (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

Physics interest of a forward spectrometer is considered. In two-photon physics, a forward spectrometer is clearly needed because most electrons are scattered at very small angle. The Weizacker-Williams approximation shows clearly this feature. The hadron cross section $\gamma\gamma \rightarrow$ hadrons consists of two processes; the first is from the vector dominance model (VDM), and the second is a point like term due to the process in which two quark jets will be produced and a large contaminant from the VDM process exists in the forward direction. The C = +1 resonance produced by two-photon collisions and a deep inelastic scattering in which one electron emits a photon with high Q^2 are worthwhile to investigate. The features of the spectrometer are as follows: 1.5 kgm magnet, drift chamber $\Delta p/p^2 < 1.4$ % p, NaI array 22-100 mr, Pb scintillator counter 100-180 mr, TOF at 5 m, and muon identifier. At the first stage of the experiment with the PEP-9 detector, there were a lot of problems due to beam-related noise. A trigger was set up on a single tag and a track in the first muon chamber. Two photon products were seen in either the same arm or the opposite arm as the tagged electron, and the data were roughly in agreement with the QED prediction for ee $\rightarrow$ ee $\mu\mu$. Other processes are being observed.

5197 (KEK—82-1, pp 587-611) **Report of fine dE/dx sampling with longitudinal drift chamber at INS.** Naito, F. (Tokyo Univ. of Agriculture and Technology, Koganei (Japan). Faculty of Technology); Imanishi, A.; Ishii, K.; Ohshima, T.; Okuno, H. May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

The parameters of the test chmber used are given in comparison with the values reported by Ludlam et al. The following features were investigated by the test, keeping practical application in mind: the length of the drift space, the width of the unit cell, the effect of a magnetic field and the readout circuits. For the first stage of the investigation, the goal was to confirm the improvement of particle identification by the fine sampling method with a chamber having long drift space and a simple readout circuit. As the result, the improvement of the resolving power for particle identification by a factor of 1.8 was obtained. The simple circuit offers a large economical advantage when numerous sensing wires are used for a large scale application. A simple readout scheme that might reduce the electronics cost enormously is suggested. At the second stage of investigation, the influence of a magnetic field was studied. The non-linear relation between drift distance and drift time due to the E x B effect around a sensing wire produced bump-dip structure on the time-sliced pulse height spectra. A similar behavior was observed in the inclined tracks. The S-value may become worse in this case. A large detector which is based on the fine sampling method is proposed. Its outline is explained.

5198 (KEK—82-1, pp 653-673) **Presence and future of storage rings at DESY.** Soeding, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

Originally DORIS was a double ring e^+e^- or e^+e^- collider facility for beam energy up to about 3.5 GeV. At higher energy, partial filling and eventually single bunch filling becomes advantageous, and in order to reach the highest possible energy at minimum power consumption, only a single ring was operated. The maximum energy reached was 5.1 GeV, just sufficient to investigate the T resonance. The limitation was given by magnet saturation and available rf power. For the thorough investigation of the b anti-b resonance and continuum region, higher energy is desirable.

Therefore, it was decided to dismantle the DORIS, and to rebuild it completely. The most important change is related to the magnets and quadrupoles. New vacuum chambers will be smaller and smoother. The injection will be possible at 5.6 GeV highest working energy. The rebuilding was started in November, 1981, and the DORIS-2 will start the operation in May, 1982. The summary of its parameters is given. The e^+e^- storage ring PETRA has been in operation since 1978. The major future project at DESY is to build a 30 x 820 GeV^2 electron-proton collider named HERA. Since the top quark was not found in the PETRA energy range, the energy upgrading program was started.

5199 (KEK—82-1, pp 674-681) **Summary report of dedicated detectors.** Sugimoto, S. (Osaka Univ. (Japan)). May 1982. NTIS (US Sales Only), PC A16/MF A01. File Number TI85780079. (CONF-8111151—).

From 2. workshop on detectors for TRISTAN; Tsukuba, Japan (6 Nov 1981).

What performance can be expected for dedicated detectors was the main theme of discussion in this subgroup. In the case of dedicated detectors, it is possible to consider the requirement for a specific physics issue and neglect others. Therefore, single purpose detectors can be designed so that they have an ability to take clear data with good resolution, good S/N ratio and considerably low systematic error. In the TRISTAN energy range, the event rate of interesting process is estimated to be low, and the background level may be high. In order to obtain the significant signals of a rare process, excellent dedicated detectors are required. A brief survey of typical detectors was carried out. For example, toponium and Higgs physics require the good resolution of gamma detection. In the case of low energy gamma measurement, bismuth germanate seems to be a best shower material for electromagnetic calorimeters. Lead glass is often used for high energy gamma measurement because of the good energy resolution, and scintillation glass may be a detector for medium energy gamma. For accurate decay vertex measurement, solid state detector hodoscopes will be available. Compact BGO balls, huge water balls, magnetized iron boxes and modified MAC detectors are proposed for their special purposes.

5200 (KEK—82-3, pp 72-75) **Initial evacuation of vacuum system in PF electron storage ring.** Kobayashi, Masanori; Kitamura, Hideo; Horikoshi, Gen-ichi; Watanabe, Hiromi; Yamaguchi, Hiroshi (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

In the vacuum system of a PF-storage ring of the National Laboratory of High Energy Physics, the ring is composed of the deflection magnet ducts, quadrupole magnet ducts and the straight ducts without magnet. In the straight ducts, R.F. cavity, injection pulse magnet vacuum chamber and roughing vacuum chamber are inserted. The deflection magnet ducts and quadrupole magnet ducts except for bellows and flanges are made of mainly aluminium alloy, with integral cooling water channels to prepare for the temperature rise of duct walls due to radiation. The vacuum gauges mounted to the ring vacuum way and roughing system include two Baird-Atomic type hot cathode gauges and six inverted magnetron type cold cathode gauges which are calibrated relatively to the hot cathode gauges. The average distance of these gauge mounting positions is about 16 m. The vacuum system was evacuated with six roughing pump systems, each of which is composed of a 260 l/min direct-coupled oil rotary pump, a 270 l/s turbo-molecular pump, an open conductance gate valve of 4600 l/s and an 800 l/s L-type valve. The effective evacuating rate was estimated to be 140 l/s at the evacuation port. Partial pressure in vacuum ducts was measured with a mass filter type analyzer. The partial pressure of m/e = 18 was relatively large because of the system without baking and also evacuation with the sorption ion pump causes more generation of m/e = 28 than the turbo-molecular pump. The condition at electron incidence is also described.

5201 (KEK—82-3, pp 76-105) **Vacuum system of TRISTAN.** Ishimaru, Hajime; Narushima, Katsuya; Mizuno, Hajime; Watanabe, Hiromi; Kubo, Tomio (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The outline of the vacuum system for an injector of the electron-positron colliding machine, TRISTAN, is described. The whole system is made of aluminum alloy. The beam ducts are connected by automatic welding without any flange. Deflection magnet chambers and quadrupole magnet chambers were manufactured by extrusion. The chambers are connected through bellows. The kicker magnet chamber is a ceramic chamber, and its inner surface is coated with CrN or TiN. Four septum magnet chambers are provided to inject or extract electron or positron beam, which have Be windows. Some deflection magnet chambers are equipped with synchrotron radiation channels. A separator chamber is provided to set an electrostatic beam separator at the colliding point. The heating due to the impedance mis-matching is considered. Various monitors are inserted in the chambers. Main vacuum pumps are ion-pumps built in the deflection magnet chambers. Since the main pumps do not work when the magnets are not excited, small ion-pumps are provided to keep high vacuum. Bulk getter pumps are used as auxiliary pumps. Roughing pumps are turbomolecular pumps which are made of aluminum alloy. Eight rf cavities are installed in the accelerator ring. The cavities are made of soft steel, of which the inner surface is treated by electric copper plating. Two ion-pumps and a turbomolecular pump are provided for each cavity. A beam transport system from a 2.5 GeV linear accelerator is constructed.

5202 (KEK—82-3, pp 113-125) **Temperature and load characteristics of a 50 1/s turbomolecular pump.** Narushima, Katsuya; Ishimaru, Hajime (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number TI85780074. (CONF-8203186—).

From 4. meeting on ultra high vacuum techniques for accelerators and storage rings; Oho, Ibaraki, Japan (12 Mar 1982).

The characteristics of 50 l/s turbomolecular pumps as roughing pumps were examined. The pumps to be tested were supplied from four manufacturers. The cooling of the pumps was by fans. The temperature characteristics were tested by making simultaneous start-up of the pumps together with rotary pumps. At the start, the temperature of the external walls of pumps was at the room temperature. The external wall temperature became equilibrium state one hour after the start-up. The difference of the equilibrium temperature from the room temperature was less than 13 degrees. The inlet pressure and the back pressure were measured by a Pirani gauge. The shortest time to the cross point of both pressures was 32 min after the start-up, and the pressure at that time was 1.5 Torr. After 3 hours operation, the vacuum of about 10^{-3} Torr was obtained by each pump. By low temperature baking, the vacuum in the range between 10^{-9} and 10^{-10} Torr was obtained.

5203 (KEK—82-10) **Design of a transverse feedback system for the Tristan Accumulator Ring.** Pellegrin, J.L.; Ieiri, Takao; Mizumachi, Yoshihiko. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1982. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703275.

Design principle of the transverse feedback system for the TRISTAN Accumulator Ring (AR) is described. Wide band beam deflection system and stripline type pick-up electrode have been adopted. Overall feedback gain of 56 dB and a damping time of 68 μs are foreseen.

5204 (KEK—82-12) **Design study of A2 - 5.5 GeV e^+e^- colliding storage ring.** Chen, Limin; Yokoya, Kaoru. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Nov 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703276.

Results of a design study are presented for an e^+-e^- colliding storage ring of beam energy from Psi to Upsilon region. Three kinds of optics are prepared for low, middle and high energy region. The luminosity estimated for beam-beam tune shift Fof 0.04 is about 5 x 10^{31} /cm^2/ sec in the high energy region and is smaller by one order of magnitude in Psi region.

44 INSTRUMENTATION

5205 **(CONF-841007—24) Technique for reduction of coherence function bias error.** King, W.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02. File Number DE85002593.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The bias error in the coherence function is found to arise from the calculation of the square magnitude of the cross-power spectral density when the real and imaginary components are not converged. Therefore, the bias error of the coherence function can be decreased significantly without averaging more data blocks if the variance of the real and imaginary components are reduced by fitting the spectra of these separate components to an appropriate model.

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 4401004630, 4722, 5275, 5339, 5339, 5341, 5342, 5343, 5344, 5408, 5409, 5456, 5777, 5960, 5964, 5969

5206 **(AD-A—144057/7) New method in elementary particle detection. Final report.** Weber, J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 30 Jun 1984. 45p. NTIS, PC A03/MF A01.

Theory is given for momentum transfer to an ensemble of particles by incident neutrinos or antineutrinos, in such a way that subsequent measurements cannot reveal the detailed characteristics of this transfer. It is shown that large scattering cross sections may be obtained, proportional to the square of the number of scatterers. Experiments are described for observations at energies of about 12 kilovolts and in the one million electron volt region.

5207 **(FS—83-30-T) Radiation protection, measurements and methods.** (Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.); Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Jun 1983. 615p. (In German). (CONF-8210309—; GSF—A4/83). NTIS (US Sales Only), PC A99/MF A01. File Number DE85750007.

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The introductory lectures discuss subjects such as radiation protection principles and appropriate measuring techniques; methods, quantities and units in radiation protection measurement; technical equipment; national and international radiation protection standards. The papers presented at the various sessions deal with: Dosimetry of external radiation (27 papers); Working environment monitoring and emission monitoring (21 contributions); Environmental monitoring (19 papers); Incorporation monitoring (9 papers); Detection limits (4 papers); Non-ionizing radiation, measurement of body dose and biological dosimetry (10 papers). All 94 contributions (lectures, compacts and posters) are retrievable as separate records.

5208 (FS—83-30-T, pp 113-116) **High-energy photon radiation beam produced by thermal neutron capture.** Vorbrugg, W.; Zill, H.W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Photon dosemeters currently available for radiation monitoring provide reliable data only up to energies of 3 MeV. At higher photon energies, considerable measuring errors are inevitable. In nuclear power plant radiation monitoring, one has to consider the radiation emitted by the nuclide N-16, especially its high-level energies of about 6 MeV which may largely contribute to the cumulative dose rate. In order to afford efficient radiation protection, dosemeters are required properly indicating also high-energy photon radiation. For this purpose, a working group at the Braunschweig FMRB started to develop a reference source for high-energy photon radiation. Lead collimators are used to keep the beam diameter at 100 mm, and the double beam aperture at 4°. Radiation is induced by (n, γ) capture reactions of thermal neutrons. The most efficient target materials envisaged for practical use are Ti and Ni. With Ti, the highest gamma radiation energies are 6.7 MeV, with Ni 9.0 MeV. Latest experimental results and the spectral and dosimetric characteristics of the photon beams are reported.

5209 (FS—83-30-T, pp 125-128) **Technical recommendations for solid-state dosemeters for environmental monitoring.** Tuerck, D.; Ambrosi, P.; Boehm, J.; Burgkhardt, B.; Piesch, E.; Heinzelmann, M. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The recommendations especially refer to the measurement of local gamma radiation doses accumulated at long term in the surroundings of a nuclear facility and are supposed to help to reduce measurement errors. They indicate minimum service requirements for the dosimetric systems, and serviceability controls to be carried out by approval of design of the dosimetric system envisaged and by regular control irradiations and comparative measurements. The recommendations contain detailed proposals for the technical and calculating process of monitoring with the TLD and RPL systems. Most important is the extensive calibration of the dosimetric system, which is indispensable for long-term dosimetry owing to the multitude of influencing parameters. Uniform procedures are recommended for calibrating the dosimetric system, for determining all interesting influencing parameters that could lead to measuring errors, and for ascertaining the overall measuring inaccuracy for each individual evaluation.

5210 (FS—83-30-T, pp 129-131) **Design examination and approval of solid-state dosimetric systems for environmental monitoring.** Lauterbach, U. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5211 (FS—83-30-T, pp 137-140) **Alternative annealing method for rapid and accurate TLD measurements.** Regulla, D.F.; Brand, H.N. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The annealing method described allows the thermal treatment period to be reduced to $<= 30$ minutes, which considerably enhances the availability of the dosemeters. In addition, this method improves the measuring accuracy which in reproducibility measurements has been determined to be $0.1 < s\,(rel) < 1$ p.c. for single detectors. The technical equipment required is an annealing device allowing precise and reproducible control of temperature and cooling rate. Such an equipment is described, together with the experimental results obtained, showing successful annealing results within $<= +- 0.5$ p.c. The effect of the new annealing method on the shape of glow curves and the sensitivity of various TLD materials is also discussed.

5212 (FS—83-30-T, pp 141-144) **Trends of development in beta dosimetry.** Boehm, J.; Heinzelmann, M.; Wernli, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

After a brief discussion of still existing problems with the definition of quantities to be measured in dosimetry and with the calibration of dosemeters, current measurement techniques and recent developments are commented on, as e.g.: Thin thermoluminescent dosemeters which allow personal dose measurement independent of energy; dose rate meters with very small detectors allowing dose rate measurement near to and at a surface. These developments in principle solved the problem of personal dose and local dose rate measurement for complex β and γ radiation.

5213 (FS—83-30-T, pp 149-152) **Microcomputers, desk calculators and process computers for use in radiation protection.** Burgkhardt, B.; Nolte, G.; Schollmeier, W.; Rau, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The goals achievable, or to be pursued, in radiation protection measurement and evaluation by using computers are explained. As there is a large variety of computers available offering a likewise large variety, of performances, use of a computer is justified even for minor measuring and evaluation tasks. The subdivision into: Microcomputers as an installed part of measuring equipment; measuring and evaluation systems with desk calculators; measuring and evaluation systems with process computers is done to explain the importance and extent of the measuring or evaluation tasks and the computing devices suitable for the various purposes. The special requirements to be met in order to fulfill the different tasks are discussed, both in terms of hardware and software and in terms of skill and knowledge of the personnel, and are illustrated by an example showing the usefulness of computers in radiation protection.

5214 (FS—83-30-T, pp 165-168) **Local dose rate monitors with scintillation detectors.** Hoffmann, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5215 (FS—83-30-T, pp 169-172) **Use of a low-cost photodiode as detector in a measuring instrument for high upsilon dose rates.** Wernli, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5216 (FS—83-30-T, pp 177-180) **Monosphere albedo measurement: A new technique for neutron measurement in fields of scattered radiation.** Piesch, E.; Burgkhardt, B. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Monosphere albedo measurement has become a standard method of analysis for fields of scattered neutron radiation. The neutron dose equivalent, neutron fluence, energy dose, energy parameter, effective quality factor, neutron fluence/dose equivalent conversion factor can thus be determined. The method and the technique of on-line evaluation by computer are discussed, and the change of the energy parameter in reactors and accelerators is illustrated by examples.

5217 (FS—83-30-T, pp 181-184) **Dosimetric characteristics of portable neutron dose rate equivalent meters.** Cosack, M.; Lesiecki, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5218 (FS—83-30-T, pp 185-188) **Application of Rossi-type detectors in radiation protection.** Menzel, H.G.; Hartmann, G.H.; Krauss, O. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Rossi-type detectors can measure the energy dose and the pertinent quality factor simultaneously and independent of the radiation. This is possible because these detectors are able to measure the energy as well as the LET distribution of the measured radiation. The quality factor is then calculated on this basis. The principle of measurement, problems and solutions are discussed.

5219 (FS—83-30-T, pp 261-262) **Computer-aided iodine monitor for nuclear power plants.** Mahnau, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5220 (FS—83-30-T, pp 265-268) **Signal processing in accumulative, continuous air monitoring for radioactivity.** Borst, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The interdependencies between detection limit and delay time in accumulative monitoring are pointed out as well as the advantages of digital over analog signal processing.

5221 (FS—83-30-T, pp 273-274) **Monitoring of liquid waste of radioisotope laboratories.** Elmer, E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5222 (FS—83-30-T, pp 239-242) **Measurements of air activation during electron accelerator operation - comparison with theoretical calculations.** Jost, P.; Weise, H.P. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Activity concentrations were measured inside and outside the useful beams of a 35 MeV linear accelerator and a 42 MeV betatron, using a conventional set-up with an unshielded and a shielded large-surface counter tube inside a lead-shielded 50 l measuring vessel. The net β counting rate was determined by means of a difference counter. The measurements in the primary bremsstrahlung beam were carried out using either a flow chamber or a closed chamber. The values measured by the different methods are in good agreement. The activities of ^{13}N and ^{15}O were measured by decomposition of the decay curves of the mixture. The results were compared with theoretical data obtained by folding the cross section with the bremsstrahlung spectra. The theoretical and measured data varied by less than 30%.

5223 (FS—83-30-T, pp 243-247) **Room air and off-air monitoring in an industrial radiochemical laboratory.** Fricke, J.L.; Haberkorn, U.; Jung, D.; Mohs, E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The room and off-air monitoring system is described. Of its 50 different measuring points, 20 are used for monitoring of soft β sources (T, ^{14}C) and 30 for monitoring of airborne dust and absorbable airborne contaminations (^{197}Hg, sup(125/131)I, sup(99m)Tc). The different detector types are described. Due to the different limiting values set for room and off-air contaminations, the sensitivities of the measuring instruments differ greatly. Various detectors for T, ^{14}C, and sup(125/131)I are described. The problems of simultaneous monitoring of T and ^{14}C in the off-air are discussed.

5224 (FS—83-30-T, pp 253-255) **Radon monitoring in the air of a uranium mine; measures to lower the concentration of radon and its decay products.** Keller, G.; Dudler, R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

While driving a test shaft down to a depth of about 40 m in a test uranium mine, the concentrations of the radioactive noble gas Rn-222 and its decay products were measured. Calibrated ionisation chambers and a special α monitor are described. The in-shaft Rn-222 concentration, averaged from location-dependent, time-dependent and ventilation-dependent measured values, was 25×10^3 Bqxm^{-3}; the mean potential α energy concentration of the decay products was 0.8 WL and the mean equilibrium factor between 0.1 and 0.2. In the hardly ventilated test chamber, the mean annual radiation exposure due to inhalation is estimated at 10 WLM. Assuming a quality factor Q of 20 and a dose conversion factor of 0.002 Gy/WLM, the mean annual dose equivalent for both lungs is 0.4 Sv.

5225 (FS—83-30-T, pp 257-260) **Iodine monitor for high background dose rates.** Kreiner, H.J.; Schomandl, A. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

A mobile aerosol iodine monitor was developed for use in intervention phases by which iodine concentrations of 5×10^9 Ci/m^3 can be measured even at a dose rate of 100 mR/h. The absorption material is continuously exchanged, and the monitor is equipped with a special NaI detector stabilized with regard to photomultiplier intensification by means of Peltier cooling at 12°C. Background radiation is largely excluded by a 5 cm lead shield, a compensation channel, on optimum signal-to-noise ratio of the detector set-up, and by optimized scintillator dimensioning.

5226 (FS—83-30-T, pp 281-284) **upsilon delay monitors in nuclear power plants.** Klatt, H.E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

A NaI monitor with high sensitivity, good measuring geometry, microprocessor-controlled background subtraction, and automatic alarm is described.

5227 (FS—83-30-T, pp 285-288) **Use of the pulse-shape method in measuring devices with large-surface proportional counting tubes for efficient separation and simultaneous indication of the α and β impulse rate.** Kiefer, H.; Reinhardt, B.; Roeber, H.G.; Ugi, S. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

By using new, low-capacity large-surface proportional counters with appropriate electronic components it was possible to clearly separate α and β radiation within the first 25 ns of the impulse rise. As an example a device for contamination measurements by hand is presented which functions according to this principle and measures and indicates α and β radiation at the same time. The principle makes use of the ionization density produced in the counting gas by the individual particle.

5228 (FS—83-30-T, pp 289-292) **VICKSI monitor interlock system.** Borchardt, D.; Kluppak, B. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Dose rate equivalents are monitored separately for all working areas and evaluated by a central unit. The accelerator is shut off automatically if the maximum permissible concentrations given in the Radiation Protection Ordinance are exceeded and if persons are endangered. However, the experimenter may, on his own responsibility, define certain areas as 'vacated' (no staff members inside). Operation can then proceed as desired. Entry of persons into these areas is checked by the central computer.

5229 (FS—83-30-T, pp 297-300) **Use of microcomputers in radiation protection and dosimetry.** Riedel, K.; Hein, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The state of the art of ^{131}I monitoring in the liquid waste of nuclear medical departments and of TL dosimetry in radiotherapy is illustrated by examples.

5230 (FS—83-30-T, pp 301-305) **Quality control in liquid waste monitoring by means of interlaboratory experiments.** Arndt, J.; Fusban, H.U.; Gans, I.; Ruehle, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The interlaboratory experiments prescribed by law have the purpose of detecting systematic errors in the participating laboratories. Further, data evaluation by a variance analysis helps to determine the 'comparability' of a quantity by which measured values from different laboratories can be assessed. Comparability values of different nuclide groups are presented as a function of concentration and discussed from the practical point of view.

5231 (FS—83-30-T, pp 357-360) **Calibration of a Ge(Li) detector for environmental monitoring.** Winkelmann, I.; Haimerl, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Soil radionuclide concentrations can be measured quantitatively by direct spectrometry. The concentrations of natural radionuclides measured in a soil sample were compared with the results of in-situ γ spectrometry using a Ge(Li) detector. An analysis of the findings showed that in-situ γ spectrometry is a valuable technique for obtaining accurate and detailed information on the type and activity of the background radiation. Even minor changes in the background radiation, e.g. resulting from man-made radionuclides, can be detected and measured by this technique. Owing to the possibility of fast background radiation measurement, the method is

recommended for the planning of emergency measures in nuclear facilities.

5232 (FS—83-30-T, pp 361-364) **Environmental monitoring in the vicinity of large-scale accelerators.** Rau, G.; Wittekind, D. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Dose rates are recorded continuously along the circumference of the CERN site by measuring stations for direct measurement of photons (charged particles) and neutron radiation. Radioactive emissions with liquid and gaseous waste are measured at the points of discharge. Owing to the dimensions of the CERN area (540 ha) and the rapidly changing operating conditions within its facilities, a vast network of monitoring stations (about 60), a complex data transmission network and a central data acquisition and data processing system are necessary. Thermoluminescence dosemeters supplement the data of the measuring stations. Radioactivity measurements in samples of aerosols, precipitations, groundwater and surface water, biological materials etc. help to assess the environmental impact of the CERN facilities.

5233 (FS—83-30-T, pp 365-367) **Use of a computer system for radiation protection.** Barz, H.G.; Borchardt, D.; Hacke, J.; Kirschfeld, K.E.; Kluppak, B. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5234 (FS—83-30-T, pp 369-372) **Programmable pulse and analog data logger for environmental monitoring.** Winkler, R.; Hoetzl, H.; Jahrstorfer, H.; Moosmaier, F. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

A programmable data logger with 16 analog channels and 8 pulse channels is described to which nuclear radiation detectors, meteorological measuring instruments and transducers were connected for registration of operating data in the course of a research project in which natural and man-made radionuclide concentrations were measured near the ground. The set-up can be modified for other measuring and monitoring tasks.

5235 (FS—83-30-T, pp 407-410) **Passive radon dosemeter with nuclear track detector.** Urban, M.; Piesch, E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

A diffusion chamber with nuclear track detector has been developed. For this radon dosemeter, the properties of three different nuclear track detectors, CR 39, LR 115 and makrofol, have been studied, as for instance the background track density and their distribution, the sensitivity to radon with evaluations in defined energy groups, and the lowest detection limit. For monitoring measurements throughout the FRG, makrofol is used as a nuclear track detector. By means of electrochemical etching tracks of about 100 to 150 μm in diameter are obtained, which are counted on a photocopy after 20-fold enlargement. Several calibrations have been made. The detection limit of this method is about 17 pCi/l a day.

5236 (FS—83-30-T, pp 411-417) **Monitor for continuous, separate detection of radon and thoron decay products in ambient air.** Wicke, A. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

A transportable monitor for continuous, separate detection of radon and thoron decay products in buildings has been developed. This method is based on the deposition of airborne particulates on a stationary membrane filter with subsequent follow-up measurement of α-activity using a surface barrier detector. The α-radiation spectra are taken by a multichannel analyser and the data are recorded every hour on a magnetic tape cassette. After a period of about 10 days the magnetic tapes are read and evaluated off-line by a laboratory computer, taking into account the α-energies of Po-218 (6.0 MeV), Po-214 (7.69 MeV), and Po-212 (8.78 MeV). With a detection probability of the detector of 17% and an air flow through the pump of 0.5 l/min, the lowest detection limit is 10^{-8} J/m³ (0.5 mWL) of potential α-energy concentration. Such monitors are installed in selected dwellings in order to study the daily and seasonal variations of potential α-energy concentration.

5237 (FS—83-30-T, pp 475-482) **Monitor for alpha-aerosol measurement.** Kreiner, H.J.; Georgi, P. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The measuring unit described operates under permanent partial vacuum in the measuring chamber, at 500 mbar. For continuous operation, use of a nozzle is necessary which is to be designed so as to avoid deposition in the suction area as far as possible. The unit has been extensively tested, the results revealing a detection limit of 8×10^{-13} Ci/m³ for Pu-239 aerosols even at a concentration of natural aerosols of 5×10^{-10} Ci/m³.

5238 (FS—83-30-T, pp 485-494) **Problem of the detection threshold in radiation measurement.** Rose, E.; Berger, H.U.; Krause, W.J.; Wueneke, C.D. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

In all cases encountered in practical radiation measurement, the basic problem is to differentiate between the lowest measured value and the zero value (background, natural background radiation, etc.). For this purpose, on the mathematical side, tests based on hypotheses are to be applied. These will show the probability of differentiation between two values having the same random spread. By means of these tests and the corresponding error theory, a uniform treatment of the subject, applicable to all problems relating to measuring technique alike, can be found. Two basic concepts are found in this process, which have to be defined in terms of semantics and nomenclature: Decision threshold and detection threshold, or 'minimum detectable mean value'. At the decision threshold, one has to decide (with a given statistical error probability) whether a measured value is to be attributed to the background radiation, accepting the zero hypothesis, or whether this value differs significantly from the background radiation (error of first kind). The minimum detectable mean value is the value which, with a given decision threshold, can be determined with sufficient significance to be a measured value and thus cannot be mistaken as background radiation (alternative hypothesis, error of 2nd kind). Normally, the two error types are of equal importance. It may happen, however, that one type of error gains more importance, depending on the approach.

5239 (FS—83-30-T, pp 495-498) **Description and treatment of measured data close to or below the detection threshold.** Voelkle, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Routine measurements for environmental radiology monitoring often deliver long series of measurd data close to or below the

detection threshold, as many samples show only very low levels of radioactivity, and data evaluation has to take into account and deduct the background. This paper explains a method of graphically representing such series of measured data, e.g. for reports, in a way providing information on mean values, scattering, most frequent values, type of frequency distribution, etc. This is of particular importance in case of the various data not belonging to the same parent population (as e.g. with frequency distributions with two maxima), or in case of the distribution being non-symmetrical (e.g. Poisson distribution, or log-normal distribution). The method presented allows statistically well-founded statements to be made on the entire material, also including measured data which seemingly provide only little or even no information.

5240 (FS—83-30-T, pp 499-501) **Some statements on the detection threshold of radioactivity measuring instruments.** Berger, H.U. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

It is shown that, from the point of view of practical radiation protection, the concept of 'detection threshold' is misleading if, when determining the detection threshold, errors of 2nd kind are not fully taken into account. An 'error of 2nd kind' is defined to be the incorrect assumption of 'no contamination' on the basis of a single measuring result which showed a net counting rate below the uncertainty of the background counting rate. These errors are caused by the fact that, due to the statistical nature of the radiation process, the net counting rate of a sample, measured just once, may be below its expectation value.

5241 (FS—83-30-T, pp 503-516) **Treatment of measured values around the detection threshold by 'quantization' of measured data.** Rose, E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Concluding statement: The scale begins with zero, with further division proceeding in equidistant steps in the positive range. 0.5 is the limit for deciding whether a measured value belongs to the scale interval 0 or 1. Values smaller than 0.5 on the scale shall be defined to be zero.

5242 (FS—83-30-T, pp 561-564) **Biochemical indicators of radiation exposure.** Stamm, A.; Boegl, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

In spite of 20 years of experimental studies, there are still no valid techniques for estimating radiation exposure in man, especially in the low dose range. Biochemical indicators, for example, are often not permanently modified after radiation exposure; after reaching a maximum or minimum value, they go back to normal. Further, biochemical parameters show a wide scatter; they are difficult to reproduce, and the results obtained in animals can hardly be transferred to humans. Thirdly, most of the biochemical changes are observed only in the high dose range.

5243 (IAEA-R—2462-F) **Detection of fast neutrons by individual dosimetry using stimulated exoelectron emissions. Final report for the period 15 November 1979 - 31 May 1982.** Petel, M. (International Atomic Energy Agency, Vienna (Austria)). Nov 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703259.

Since 1979 studies were carried out at the French Atomic Energy Commission under an IAEA research contract on the detection of fast neutrons for personal dosimetry using thermally stimulated exoelectron emission (TSEE). Initially, alpha-alumina, which is alumina crystallizing in the α-phase, was used as the dosimeter. The exodosimeters were prepared by the pulverization technique using plasma arc and chemical flame deposition technique; the former was the better technique. With the plasma arc technique the alumina layers became indestructible, the surface of the layer was very homogeneous and the crystalline structure remained undisturbed. Later, the study was extended to other exoelectron emitting materials, namely, beryllium oxide and lithium fluoride. The response of the three types of exoelectron dosimeters was studied by exposing them to unidirectional neutron beams of fluences varying between 10^8 and 10^9 neutrons per cm^2 from ^{7}Li (n,p) reaction for the energy range 75-500keV and from ^{3}H (n,p) reaction for 1MeV. With the three exoelectron dosimeters studied, the sensitivity for neutron detection, Rn, was found to be rather poor as compared to the sensitivity to gamma rays, Rγ. The Rn/Rγ ratio obtained by using the glow peak at 360 deg. C was not more than 6%. However, by taking into account the two peaks at 360 deg. C and 470 deg. C the average Rn/Rγ ratio was found to be 60%. Although this could be used for neutron dosimetry, it had two major drawbacks, namely (a) the resolution was very poor as compared to that obtained by using the peak at 360 deg. C alone and (b) thermoionic background at high temperature reduced the reproducibility of measurements. Simultaneously, a TSEE reading device was developed and this was an engineering success. The results of the study have been of scientific interest, but the use of this technique for practical neutron dosimetry has not yet proved to be a success.

5244 (INS-TH—150) **Drift chamber system for high energy experiments.** Ishii, T.; Watanabe, K.; Takeuchi, Y.; Shimura, N. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Dec 1982. 18p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703297.

A wire spark chamber (WSC) system had been used to determine particle tracks behind the analyzer magnet in high energy experiments at 1.3 GeV electron synchrotron, but it sometimes caused troubles such as spark noises, consumption of the Krytron pulser and so on. The WSC system has been rpeplaced with drift chamber (DC) system for the experiment to measure angular distributions of the differential cross section in proton Compton scattering. These DC's are of two dimensional readout type based on the drift time measurement and the charge division method. In this paper, the structure, the readout electronics and the results of the beam test of the DC's are describeeded ibed described.

5245 (INS-TL—144) **Analytical orbit calculation of the INS air-core $\pi\sqrt{2}$ β-ray spectrometer for the measurement of electron anti-neutrino mass. Simultaneous use of an extended source and a position sensitive counter.** Shoji, Y.; Fujioka, M.; Kawakami, H.; Hisatake, K.; Ohshima, T. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1983. 116p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE84703296.

For the measurement of electron anti-neutrino rest mass with the INS air-core(iron-free) β-ray spectrometer, the orbit calculations were carried out for the case of simultaneous use of an extended source and a position-sensitive electron counter. Analytical calculation up to the 3rd-order approximation results in design parameters of 16cm x 7cm source area, 0.095% transmission, 4% momentum acceptance and 67.6° and 4.19° tilt angles of the source and the detector planes, respectively, for 0.05% momentum resolution. These values imply a 7 times larger sensitivity to the electron anti-neutrino mass than in the recent experiment by ITEP group.

5246 (Juel-Spez—255, pp 140) **Morris chamber Calibration utility MOCAL.** Meissburger, J.; Paul, D. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5247 (Juel-Spez—255, pp 141-142) **Detectors at the BIG KARL spectrometer.** Hlawatsch, G.; Paul, D.; Berg, G.P.A.; Brinkmoeller, B.; Meissburger, J.; Roemer, J.G.M.; Rogge, M.; Tain, J.L.; Brentano, P. von; Moore, C.F. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5248 (Juel-Spez—255, pp 143-144) **Semiconductor detectors.** Hamacher, A.; Kuenster, T.; Lawin, E.; Metz, H.; Nicoll, K.; Protic, D.; Riepe, G. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5249 (Juel-Spez—255, pp 144) **Light particle detection by BGO-scintillators with photodiode readout.** Glasow, R.; Kampert, K.H.; Loehner, H.; Gaul, G. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5250 (Juel-Spez—255, pp 145) **Position sensitive parallel plate avalanche detectors for fission fragments.** Zemlo, L.; Hlawatsch, G.; Decowski, P.; Morsch, H.P. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5251 (Juel-Spez—255, pp 145) **Small size plastic scintillation counters for measurement of protons up to 100 MeV.** Siebert, R.; Decowski, P.; Morsch, H.P.; Rogge, M.; Turek, P. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5252 (Juel-Spez—255, pp 146-147) **High resolution spectrographs.** Ikegami, H. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5253 (Juel-Spez—255, pp 152) **Electronic division.** Labus, H.; Bojowald, J. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5254 (KEK—82-8, pp 53-59) **Feasibility of determining the neutrino mass through observation of Auger electron intensities.** Stefan, P.M.; Ohta, T. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

An attempt was made to assess the experimental feasibility of determining the mass of electron neutrino by the measurement of Auger electron intensity from the decay of Ho-163. The intensity of various Auger transitions gives the quantitative information on the relative capture rate of the various electrons in atoms. In the case that a Ho-163 sample is synthesized with a CYRIC cyclotron and the current technology is used for detecting Auger electrons, the counting rate for a particular transition was estimated. The estimation of the counting rate was made by assuming that among all transitions, the electron-capture rate is proportional to the "normalized multiplicity". The energy range for detecting the Auger electrons was also examined. The counting rate estimated was insufficient to permit to determine the relative intensity of transitions utilizing the various captured-electron vacancies. The present conclusion may be reversed only if the sample obtained is 30 to 50 times more powerful.

5255 (KEK—82-8, pp 40-48) **Measurement of Ho-163 with a Si(Li) detector.** Ishii, Keizo; Sera, Koichiro; Shinozuka, Tsutomu; Fujioka, Manabu (Tohoku Univ., Sendai (Japan)); Yasumi, Shinjiro. Sep 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

The Dy M X-ray from a Ho-163 source was measured with a Si(Li) detector to identify the Ho-163 and to determine its yield. The measurement was performed for the Ho-163 sources by both internal and external beam irradiations. The external beam irradiation was made for both natural and enriched Dy metal foils. In these cases, however, Dy M X-ray was not detected. For the Ho-163 source by the internal irradiation and the chemical separation, the X-rays of Msub($\alpha\beta$), 4s-3p and 5p-3s in Dy were observed, and the production of Ho-163 was confirmed. In order to know the amount of Ho-163 in the Ho-163 source and to estimate the half-life of Ho-163, a quantitative analysis of Ho element was made using the PIXE method. The total amount of Ho-163 for four Ho sources was estimated to be 4.0 +- 0.8 micro-grams. A low-background measurement with a Si(Li) detector was also tested, but the internal bremsstrahlung X-ray was not observed.

5256 (KEK—82-9) **Computer control system for the KEK 1-M hydrogen bubble chamber.** Ujiie, N.; Ishihara, N.; Ohama, T.; Otake, Y.; Sugahara, R.; Tadano, M. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. 43p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703298.

A temperature and pressure control system of the KEK 1-m hydrogen bubble chamber has been converted from a conventional analogue system to a Direct Digital Control System (DDC) using a minicomputer YODIC 100. The system has two operation modes. The "cooling mode" of the DDC system (mode I) enables us to automatically cool the chamber down to 45 K with a desired cooling rate. The "constant operation control mode" (mode II) can keep the fluctuation of the temperature and the pressure of the chamber to within +-0.02 K and +-0.02 kg/cm^3, respectively. The constitution and the performances of the DDC system are described.

5257 (LA-UR—84-3304) **Multipurpose radiac for field surveys and training.** Wolf, M.A.; Bjarke, G.O.; Jarrett, J.D. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-841007—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002383.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The Instrument Technologies Group at Los Alamos has developed a multipurpose radiac. It uses a variety of detectors coupled with a CMOS microprocessor to provide ease of use and an unambiguous display. It allows concurrent surveys for alpha, beta, gamma, and neutron radiation. In addition, it has an external data link for coupling to and from data acquisition/storage equipment, hence making it a perfect training tool. The instrument is small (4x8x2.4 in.) and lightweight (<2 lbs). It runs for 50 hours on common batteries.

5258 (LA-UR—84-3305) **Simple MCA supports a variety of applications.** Wolf, M.A.; Staley, H.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 3p. (CONF-841007—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002382.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A greatly enhanced version of the Violinist I, Simple Multichannel analyzer has been developed at Los Alamos. The new instrument includes a more powerful microprocessor, more memory, and a sophisticated set of I/O devices. The combination of these features allow the same basic electronics package to function in a variety of smart sophisticated monitoring instruments. Only the packaging, detector, and software need be changed to change the instrument from a field survey instrument for Pu contamination to a continuous air monitor to a neutron dosimeter. This instrument should spawn a new generation of user-friendly, highly effective instrumentation.

5259 **(LA-UR—84-3389) Beta-gamma discriminator circuit.** Erkkila, B.H.; Wolf, M.A.; Eisen, Y.; Unruh, W.P.; Brake, R.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-841007—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002378.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The major difficulty encountered in the determination of beta-ray dose in field conditions is generally the presence of a relatively high gamma-ray component. Conventional dosimetry instruments use a shield on the detector to estimate the gamma-ray component in comparison with the beta-ray component. More accurate dosimetry information can be obtained from the measured beta spectrum itself. At Los Alamos, a detector and discriminator circuit suitable for use in a portable spectrometer have been developed. This instrument will discriminate between gammas and betas in a mixed field. The portable package includes a 256-channel MCA which can be programmed to give a variety of outputs, including a spectral display, and may be programmed to read dose directly.

5260 **(MPI-PAE/Exp.El.—129) Recent progress in BGO development for high resolution calorimetry.** Lorenz, E. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Jun 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750017.

The recent progress in BGO development for use in high resolution electromagnetic calorimetry will be discussed.

5261 **(MPI-PAE/Exp.El.—130) Concept for a hadron calorimeter with photodiode readout.** Dietl, H.; Eigen, G.; Fonseca, V.; Lorenz, E.; Mageras, G. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Jun 1984. 22p. (CONF-8405241—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750009.

From Seminar on perspectives for experimental apparatus at future high energy machines; Florence, Italy (21 May 1984).

A concept for a hadron calorimeter will be described. The calorimeter is a scintillator sandwich type with WLS-bars and photodiode readout. Emphasis is put on compactness, high stability, easy fabrication, and safety.

5262 **(MPI-PAE/Exp.El.—131) Improvements in photodiode readout for small CsI(T1) crystals.** Grassmann, H.; Moser, H.G.; Dietl, H.; Eigen, G.; Fonseca, V.; Lorenz, E.; Mageras, G. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Jun 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750016.

Measurements of photon energy resolution in the region around 1 MeV with a small CsI(Tl) photodiode detector will be presented.

5263 **(PB—84-221688) Extension of the congruent electromagnetic scale to gamma rays. Final report.** Deslattes, R.D. (National Bureau of Standards, Washington, DC (USA)). 1983. 18p. Pub. in Proceedings of NATO Advanced Study Inst. Quantum Metrology Fund. Phys. Constants held at Erice, Italy on November 16-28, 1981, p365-382 1983.

Precision spectroscopy in the region of x rays and gamma rays has a considerable range of application in determination of fundamental constants, tests of basic theory and determination of masses of elementary particles. The current panoply of such applications is addressed in the lecture. The aim of this presentation is to focus on the measurement technology required to establish secondary reference standards. Intrinsic limitations due to x ray line shapes and the measurement technologies are summarized. A new stage in this work has now been established using x ray interferometry followed by small-angle diffraction to cover six orders of magnitude in two steps thereby tying gamma rays to visible light in a way not limited by the characteristics of x ray lines and without the accumulation of errors characteristic of previous multistep procedures. Present and future limitations are indicated.

5264 **(PB—84-221720) Physics and mathematics of beta-particle dosimetry for radiation protection. Final report.** Loevinger, R.; Seltzer, S.M.; Heaton, H.T. II. (National Bureau of Standards, Washington, DC (USA)). Jan 1984. 14p. Pub. in Proceedings of Int. Beta Dosimetry Symposium, Washington, DC, February 15-18, 1983, p1-14 January 1984.

Fast electrons interact with matter through many elastic and inelastic collisions with atomic electrons and nuclei. The effects of these interactions are often described in terms of collision stopping power, radiative stopping power, angular scattering, electron range, and range straggling. Electron transport theory combines these effects to provide a description of the penetration of the electrons, and the deposition of energy in materials of interest. Calculations of interest in radiation protection have been performed for mono-energetic electron sources and for beta-particle sources, and the results can be expressed in terms of point and plane kernels. The energy dependence of the results can often be greatly reduced by suitable scaling. The physical information and mathematical methods that constitute the basis of beta-particle dosimetry for radiation protection are surveyed.

5265 **(SLAC—273) SLD Design Report.** (Stanford Linear Accelerator Center, CA (USA)). May 1984. Contract AC03-76SF00515. 392p. NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE85003057.

This Design Report describes the plans for the construction of the second detector for the SLAC Linear Collider to study e^+e^- collisions at energies of up to 100 GeV in the center-of-mass. Particle tracking and momentum measurement are provided by a vertex detector, a high-precision central drift chamber, and pairs of endcap drift chambers, all in a 1 Tesla magnetic field produced by a superconducting solenoid. Particle identification is provided by CRIDs (Cerenkov Ring Imaging Detectors). Calorimetry is done in two parts; a liquid argon calorimeter (LAC) with uranium and iron radiators is located inside the coil, and the laminated iron of the flux return is instrumented with limited-streamer-mode tubes to complete the hadron calorimetry. The streamer tubes of this warm-iron calorimeter, called the WIC, are instrumented with strip readout to provide muon tracking in addition to calorimetry. The same technology is used on the end structures of the detector and the central region, thus providing uniform response in both regions.

5266 **(SLAC-PUB—3462) Programmable synchronization unit.** Kang, H. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 3p. (CONF-841007—25). NTIS, PC A02. File Number DE85002685.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A Programmable Synchronization Unit (PSU, 135-726) has been designed as an element of the new timing system for the Stanford Linear Collider (SLC) project to provide synchronization signals needed for various apparatus in the SLC Damping Ring, or anywhere it is necessary to monitor longer than the fiducial period ($\simeq$ 2.8 μs). A 119 MHz pulse train derived from the 476 MHz main drive line and superimposed with 360 Hz fiducial signal is the frequency source. Following a programmable delay D of up to 4.4 μs, the PSU can deliver N pulses of width W (in increments of 8.4 ns) with a pulse period of P (in increments of 58.8 ns, the damping ring half period). The device may be programmed at any time during the interfiducial period.

5267 **(SLAC-PUB—3464) Versatile CAMAC power supply controller-monitor with built-in ramping and ripple monitor.** Kang, H.; Horelick, D. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 3p. (CONF-841007—23). NTIS, PC A02. File Number DE85002686.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

An integrated power supply controller-monitor has been designed and is in use to control large power supplies for SLC dc magnets. This single-width CAMAC module contains a 14-bit DAC, a 14-bit ADC, and several channels of optically coupled digital status and control signals. Additional features include built-in

selectable ramping rates, self-test capabilities, and a ripple monitor circuit to measure ac ripple in the power supply current.

5268 **(SLAC-PUB—3468) Hi-speed versatile serial crate controller for CAMAC.** Horelick, D. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 4p. (CONF-841007—26). NTIS, PC A02. File Number DE85002687.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A serial crate controller, primarily for use in the SLC CAMAC control system, has been designed, and has been in use for about 2 years. The design supports a party line approach, with up to 16 crates on a single twisted pair for data transfers, plus another pair for prompt L response. The bit rate is 5 megabits/s, and complete transaction times of about 10 μs are achieved for 16-bit data transfers over cables up to 1000 feet long. One of the primary objects of the design was simplicity - there are approximately 60 chips in the two-board unit.

5269 **(UCRL—15419-2) Climax spent fuel dosimetry. Progress report, September 1982-January 1984.** Quam, W.; DeVore, T. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). Jun 1984. Contract W-7405-ENG-48. 241p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001055.

This report covers work done during FY83. These tasks included: (1) recovery and readout of the final set of dosimeters from the Climax facility, (2) a calibration exposure at the Sandia Gamma Irradiation Facility (GIF) to verify temperature effects during irradiation, and (3) a recalculation of new and existing calibration data over the range of 2 x 10^3 to 10^8 rads-LiF. This new set of calibration data is slightly different from that previously reported, and incorporates the best temperature corrections determined thus far. Data previously reported have been corrected and tables of a consistent set of these data are provided. The high-range dosimetry required for this project was achieved by exploiting the radiation-induced increases in optical absorption in LiF. This phenomenon is manifested as a series of peaks in the absorption spectrum; two of these peaks have proved useful for the dosimetric purposes at hand. The first, centered at 247 nm, covers the range of 2 x 10^3 to 9 x 10^6 rads-LiF; while the second, at 374 nm, covers the overlapping range of 2 x 10^6 to 10^8 rads-LiF. Optical absorption was measured with a double-beam spectrometer in absorbance units (AU), equivalent to the common log of the reciprocal of the optical transmission.

5270 **Time-projection chambers.** Madaras, R.J.; Oddone, P.J. *Physics Today;* **37**: No. 8, 36-47(Aug 1984).

A gas in parallel electric and magnetic fields makes an elegant detector able to identify particles over a broad momentum range and to measure their tracks in three dimensions.

5271 **Radiation measuring system using transistor flux sensors.** Josephson, V. US Patent Application 6-619,240. 11 Jun 1984. 34p.

Document describes an ionizing radiation intensity dosimeter apparatus and method based on carrier recombination saturation times for irradiated PN junction semiconductor devices following termination of a radiation pulse. Normally on quisecent condition, moderate radiation doses at relatively high dose rates, and a readout arrangement employing gated burst counting are included.

5272 **A mobile gamma scanning system for detecting radiation anomalies.** Myrick, T.E.; Blair, M.S.; Doane, R.W.; Goldsmith, W.A. (Oak Ridge National Laboratory, Health and Safety Research Division and Instrumentation and Controls Division, Oak Ridge, Tennessee). *Nuclear Technology;* **62**: No. 3, 364-370(Sep 1983).

A mobile gamma-ray scanning system has been developed by Oak Ridge National Laboratory for use in the U.S. Department of Energy's remedial action survey programs. The unit consists of NaI(Tl) detectors housed in a specially equipped van. The system is operator controlled through an on-board minicomputer with data output provided on the computer video screen, strip chart recorders, and an on-line printer. Data storage is provided on floppy disk. Multichannel analysis capabilities are included for qualitative radionuclide identification. A ^{226}Ra-specific algorithm is currently employed to identify locations containing residual radium-bearing materials.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

5273 **(AD-A—143302/8) Length distribution of chords through a rectangular volume. Final report.** Bendel, W.L. (Naval Research Lab., Washington, DC (USA)). 3 Jul 1984. 17p. (NRL-MR—5369). NTIS, PC A02/MF A01.

The chord length distribution of penetrating radiation in rectangular parallelepipeds is of concern in regard to spacecraft electronics, as single event upsets can be produced by the ionization along the path of a high-energy particle. Both differential and integral chord length distributions are presented here. Two approximations to the integral distribution are discussed.

5274 **(PB—84-209063) Effects of transient ionizing radiation in some various of TTL-circuits in the 54/74-series.** Goeransson, G. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Mar 1984. 83p. (In Swedish). (FOA-C—30365-A3). NTIS, PC E05/MF E01.

Experimental investigations of radiation effects from transient ionizing radiation in integrated TTL-logic circuits are reported. The investigations have primarily been made with the intention to find out effects of ionizing initial radiation from nuclear weapon explosions. The investigations are made to enhance the knowledge of radiation effects in integrated circuits and thereby also get a comparison of the susceptibility for various circuits and circuit technologies. In the present report are by experiments pointed out the divergence in radiation susceptibility for various generations of TTL-circuits (Standard TTL, Schottky TTL, Low Power Schottky TTL etc.).

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 4403004790, 5213, 5302, 5793

5275 **(FS—83-30-T, pp 263-264) Design of an accident-proof iodine and aerosol sampling device.** Mahnau, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5276 **(IFIN-RB—4-1981) Folosirea spectrometrului RES ART-6 IFIN in studii cu markeri de spin.** Ionescu, M.S.; Strujan, V.; Frangopol, M.; Ciobanu, M.; Sholle, V.D.; Benga, Gh.; Frangopol, P.T. (Institutul Central de Fizica, Bucharest (Romania)). Jun 1981. 36p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780217.

Characteristics of the ESR spectrometer ART-6, made at the Institute of Phzsics and Nuclear Engineering (IFIN), Magurele-Bucharest (sensitivity 3x10^{11} spin/G, resolving power 100 mG, magnetic field stability 2x1q^{-5}, frequency stability 2x10^{-6}) are presented along with the instrumental parameters used in the study of spin labels, 2,2,6,6-tetramethylpiperidine-1-oxyl (TEMPO) and 3-methylene-5-(piperinide-N-methyl)-4-oxo-2,2,6,6-tetramethylpiperidine-1oxyl. These spin labels were used for the investigation of some biological membranes. 40 ref.

5277 **(ITEF—146(1983)) VXFIND program for processing the data from the ITEPh 3-m magnetic spectrometer.** Bystritskaya, E.V.; Shcheblykin, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703306.

The VXFIND program (FORTRAN, BESM-6 computer) intended for processing the data from the ITEPh 3-m magnetic spectrometer is described. The program permits to determine the track momentum and the vertices of events; it is intended for processing events with different topology, has the block structure and hence may be applied for data processing in other experiments. The program has been tested using simulatio'ingon and real events with different topology.

5278 **(NIM—1984) Commissioning of the AEI MS702 mass spectrometer.** Pearton, D.C.G.; Sobiecki, A. (National Inst. for Metallurgy, Randburg (South Africa)). 31 Aug 1978. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84901319.

The setting-up and commissioning of the AEI MS702 mass spectrometer are described. Its individual components and their uses are discussed, as well as the sample preparation, analysis, and reduction of data. A comprehensive list is given of instrumental breakdowns, and the application of the technique to several matrices is outlined. Improvements and modifications to the technique, including the use of a minicomputer, are suggested.

5279 **(PB—84-221134) Quantum ferroelectric pressure sensor. Final report on phase 1.** Lawless, W.N.; Clark, C.F. (Lake Shore Cryotronics, Inc., Westerville, OH (USA)). 1982. 26p. NTIS, PC A03/MF A01.

A study was undertaken to find a material that could be used as a temperature-independent, magnetic-field-independent, capacitive pressure sensor for applications below about 10 K. Although the dielectric constant in quantum ferroelectrics is large and independent of temperature at low temperatures, the known quantum ferroelectrics, $KTaO_3$ and $SrTiO_3$ were inappropriate for a practical pressure sensor. Pb substitutions were made on the A-site and Ta substitutions on the B-site of $Cd_2Nb_2O_7$, and a suitable system of materials was found. These materials have a large dielectric constant and a large pressure sensitivity. The dielectric constant is temperature-independent to over 10K, and the dielectric data are repeatable upon temperature cycling. A model for a temperature-insensitive, magnetic field independent, capacitive pressure sensor is developed and device parameters are calculated. It is concluded that such a pressure sensor would detect pressure changes as small as + or - 0.2 bar.

5280 **(SAND—84-8014) Precision volume measuring system.** Klevgard, P.A. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1984. Contract AC04-76DP00789. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002589.

An engineering study was undertaken to calibrate and certify a precision volume measurement system that uses the ideal gas law and precise pressure measurements (of low-pressure helium) to ratio a known to an unknown volume. The constant-temperature, computer-controlled system was tested for thermodynamic instabilities, for precision (0.01%), and for bias (0.01%). Ratio scaling was used to optimize the quartz crystal pressure transducer calibration.

5281 **Diffraction crystal for sagittally focusing x-rays.** Ice, G.E.; Sparks, C.J. Jr. (to Dept. of Energy). US Patent 4,461,018. 17 Jul 1984. Filed date 7 Jun 1982. vp.

PAT-APPL-385993.

The invention is a new type of diffraction crystal designed for sagittally focusing photons of various energies. The invention is based on the discovery that such focusing is not obtainable with conventional crystals because of distortion resulting from anticlastic curvature. The new crystal comprises a monocrystalline base having a front face contoured for sagittally focusing photons and a back face provided with rigid, upstanding, stiffening ribs restricting anticlastic curvature. When mounted in a suitable bending device, the reflecting face of the crystal can be adjusted to focus photons having any one of a range of energies.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 4404004398

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

5282 **(LA—10203-MS) Three-dimensional hydrodynamic hot-spot model applied to PETN, HMX, TATB, and NQ.** Mader, C.L.; Kershner, J.D. (Los Alamos National Lab., NM (USA)). Sep 1984. Contract W-7405-ENG-36. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002305.

The interaction of a shock wave with a single air hole and a matrix of air holes in PETN, HMX, and TATB has been numerically modeled. The hot-spot formation, interaction, and the resulting build up toward detonation were computed using three-dimensional numerical Eulerian hydrodynamics with Arrhenius chemical reaction and accurate equations of state according to the hydrodynamic hot-spot model. The basic differences between shock sensitive explosives such as PETN or HMX and shock insensitive explosives such as TATB or NQ may be described using the hydrodynamic hot-spot model.

5283 **(MHSMP—84-37) Interim Total Containment Test Fire Facility, Pantex Plant, Amarillo, Texas.** Papp, A.G.; Nunley, J.L.; West, G.T. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Aug 1984. Contract AC04-76DP00487. 52p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002652.

This report documents the results of a test program conducted within a confinement chamber called the Interim Total Containment Test Fire Facility. The objective was to determine the effectiveness of the chamber to contain the blast loads and hazardous fragments generated by the largest high explosive (HE) charge expected to be fired within the chamber. 11 references, 7 figures, 5 tables. (ACR)

5284 **(UCID—20179) Shock propagation in the exhaust gas handling system of the proposed large altitude rocket cell: methods and preliminary analysis.** Sutton, S.B.; Pierce, R.E. (Lawrence Livermore National Lab., CA (USA)). 4 Oct 1984. Contract W-7405-ENG-48. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003055.

Numerical predictions are to be performed of the shock pressures that would result from the detonation of 100,000 lbm TNT. The initial phase of the project was to develop the methodology for analyzing the problem, develop a preliminary conceptual design to use in initial simulations, and estimate over-pressures, inside the conceptual facility, resulting from the propellant detonation. This report discusses the methods of analysis used to study the problem of the detonation of the propellant, and the propagation of the shock wave inside the exhaust gas processing system, and presents preliminary results. The KOVEC computer code was used to simulate the detonation of 100,000 lbm TNT and develop a boundary prescription for use in the gas dynamics code GASP which models the propagation of the shock wave through the LARC exhaust gas processing system. Results are presented showing the effect of cross-sectional area changes and variations in the initial pressure in the gas processing system on the shock wave peak pressure and propagation speed.

5285 **(UCRL—90603) Polymer blends as high explosive binders.** Hoffman, D.M.; Caley, L.E. (Lawrence Livermore National Lab., CA (USA)). 5 Oct 1984. Contract W-7405-ENG-48. 32p. (CONF-8406219—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85001210.

From Annual DOE adhesives symposium; Kansas City, MO, USA (19 Jun 1984).

One approach to high-density, high-modulus binders for explosives is to blend low-density, high-modulus polymers with high-density, low-modulus polymers. Improved properties, which misci-

ble pairs theoretically should have, are discussed. Two attempts to achieve miscibility between a high-density fluoropolymer (Kel-F 800) and high-modulus thermoplastics (Lucite 130 and Phenoxy PKHJ) were unsuccessful. These blends are immiscible and their physical properties are additive or not significantly enhanced. Anelastic properties of the blends indicate phase separation by the presence of two glass transitions, one associated with each phase. Unfortunately, neither of these pairs has merit as an improved plastic-bonded explosive binder. However, a compatible (miscible) pair would be an improved binder if the appropriate polymer pair could be found.

4502 Nuclear

REFER ALSO TO CITATION(S) 4502005295, 5595, 5598

5286 **(AD—467227/5) Nature, intensity, and distribution of fall-out from Mike shot.** Heidt, W.B. Jr.; Schuert, E.A.; Perkins, W.W.; Stetson, R.L. (Naval Radiological Defense Lab., San Francisco, CA (USA)). Apr 1953. 84p. NTIS, PC A05/MF A01.

Report on Operation Ivy, Project 5.4a.

The physical and chemical properties of the particulate matter deposited following Mike shot, Operation Ivy, together with its distribution in time and area, were investigated. Total fallout and differential fall-out collectors were installed in islands, anchored lagoon floats, and free-floating sea stations about the detonation point. All collected samples were analyzed at the U. S. Naval Radiological Defense Laboratory. All the samples of primary fall-out collected were in a cross-wind direction from the detonation point; secondary fall-out samples were collected to distances of 600 miles from this point. Radiation levels as high as 800 r/hr at 2 hr were found 3 miles from the detonation point. No positive evidence of the occurrence of a base surge was found.

5287 **(AD—483423/0) Scientific director's report of atomic weapons tests at Eniwetok, 1951. Annex 6.4. Fall-out phenomenology.** Adams, C.E.; Holden, F.R.; Wallace, N.R. (Naval Radiological Defense Lab., San Francisco, CA (USA)). Aug 1951. 32p. NTIS, PC A03/MF A01.

Report on Operation Greenhouse. See also Rept. No. WT-22, dated August 1951, AD-224 534, Annex 2.3, dated August 1951, AD-224 533.

An experiment was designed to measure the fall-out pattern and to study the nature of the fall-out particles from low-level, experimental atomic bomb air bursts in order to provide data for the appraisal of the potential health hazard from external and internal exposure to the fall-out products. Samples of the fall-out from Dog and Easy Shots were obtained. A study of the size distribution of the active particles was made by size fractionation and radioautographic techniques. Radiochemical analyses of the fallout were made. In addition, a study of the structure and composition of the fall-out particles was made. It was determined that the bulk of the radioactivity in the fall-out was associated with particles greater than 5 microns in diameter. The highest radiation levels were found on Bogallua at E + 30 min. The reading was about 30 r/hr as measured from a helicopter hovering 10 to 20 ft above the island.

5288 **(AD-A—142818/4) Review of the air chemistry and relevant parameters for the modelling of nuclear-induced lightning. Interim report April-October 83.** Ali, A.W. (Naval Research Lab., Washington, DC (USA)). 31 May 1984. 50p. (NRL-MR—5341). NTIS, PC A03/MF A01.

A review of the relevant processes for the modeling of NIL and their rate coefficients is given. These include the attachment rates, the ionization frequency, the electron temperature, the various recombinations and thermal processes.

5289 **(AD-A—142883/8) Nuclear fire planning and assessment model III (NUFAM III) user's manual.** Paarmann, A.W.; DeLoach, J.M. (Army Concepts Analysis Agency, Bethesda, MD (USA)). Nov 1982. 105p. NTIS, PC A06/MF A01.

The NUFAM III Model is a two-sided stochastic combat simulation that includes target acquisition and focuses on nuclear and/or chemical fire planning and subsequent damage assessment at division or corps level. It develops a combat sample of nuclear and chemical weapon expenditures and assesses the resultant attrition on opposing forces. The model may be operated with either or both sides in a requirements or capabilities mode, and is programmed in the SIMSCRIPT computer languages.

5290 **(AD-A—995221/9) Operation Greenhouse. Scientific director's report of atomic weapon tests at Eniwetok, 1951. Annex 2.1. Japtan Island development and animal production.** (USAEC, Washington, DC). 1951. 43p. (AEC-WT—2). NTIS, PC A03/MF A01.

5291 **(AD-A—995225/0) Operation Upshot-Knothole, Nevada Proving Grounds. Project 24.2. Physical measurements of gamma and neutron radiation in shelter and instrumentation evaluation. Report for March-June 1953.** Deal, L.J.; Rossi, H.H.; Hurst, G.S. (USAEC, Washington, DC). Aug 1953. 42p. (AEC-WT—789). NTIS, PC A03/MF A01.

5292 **(NVO—285) Analysis of Operation Dominic II SMALL BOY radiological and meteorological data.** Quinn, V.E., Kennedy, N.C.; Steadman, C.R. (National Oceanic and Atmospheric Administration, Las Vegas, NV (USA). Weather Service Nuclear Support Office). Aug 1984. Contract AI08-76DP00351. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002805.

This report describes the Weather Service Nuclear Support Office (WSNSO) analyses of the radiological and meteorological data collected for the Operation Dominic II nuclear test SMALL BOY. Inconsistencies in the radiological data and their resolution are discussed. The methods of estimating fallout-arrival times are discussed. The meteorological situation on D-day and a few days following are described. A comparison of the fallout patterns resulting from these analyses and earlier (1966) analyses is presented. The radiological data used to derive the fallout pattern in this report are tabulated in an appendix. 11 references, 20 figures.

5293 **(UCRL—91268) Fire initiation and spread in urban areas due to nuclear attack.** Reitter, T.A.; Takata, A.N.; Kang, S.W. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 22p. (CONF-8409178—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003140.

From Conference on large scale fire phenomenology; Gaithersburg, MD, USA (10 Sep 1984).

Calculation of fire development in urban areas is a critical step in estimating the global effects of nuclear warfare with regard to smoke production and transport. As part of the first phase of a program to improve our ability to calculate fire starts and spread in urban areas, we have performed a parameter sensitivity analysis using the three codes originally developed for civil defense planning by the IIT Research Institute. We have added graphics and made slight improvements to the codes and applied them to the representation of the San Jose urban area used in the Five-City Study of the late 1960s. For a chosen reference attack scenario, we have varied parameters and compared the results to those of a representative baseline case. The parameters varied included: atmospheric visibility, lowest of the various critical ignition energies of window coverings, shading of windows by trees and awnings, extent of blast extinguishment of fires, secondary ignitions, window glass transmittance, specific firebrand generation rate, firebrand distribution range, windspeed, building densities, specific fuel loadings, and window sizes. 13 references, 10 figures, 5 tables.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 4503005591, 5593, 5594, 5596, 5597, 5598

5294 **(PB—84-224088) Seismology, 1983, nuclear test ban verification earthquake and earth resource investigation.** (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Mar 1984. 93p. NTIS, PC E05/MF E01.

Summary in Swedish. Color illustrations reproduced in black and white.

This progress report for 1983 is the fourth yearly report summarizing the activities of the Division of Applied Seismology of the National Defence Research Institute (FOA) in Sweden. This division of the Institute is mainly involved in seismic discrimination and nuclear explosion monitoring. Special attention is paid in this report to the development of International Data Centers as a component of a global monitoring system. The division is also conducting a project on seismic risk estimation at nuclear power plants in Sweden. This project includes operating a network of local seismic stations in Sweden. Two seismic exploration projects are also currently being conducted. One project involves the further development of seismic methods for oil exploration, and the other the investigation of crystalline rock using seismic cross hole measurement. Finally the Division of Applied Seismology is conducting a project where seismic sensor in military applications are studied.

5295 (SAND—83-2625, pp 217-243) **Data management sequence.** Long, J.W. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Accelerations are measured at several locations at Nevada Test Site and transmitted by radio to two central locations where the signals are recorded on analog tape. These tapes are then played back for approximately two minutes around the time of each event and the signals recorded on digital tapes. These data are then processed through a standard sequence of computer programs to filter out low and high frequency noise and produce the best available acceleration, velocity and displacement records. These records are used in the production of vector sum plots, PSRV plots, and various other analytical processes.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 5001004861

5296 **Identification of 10- to 20-year temperature and precipitation fluctuations in the contiguous United States.** Karl, T.R.; Riebsame, W.E. (National Climatic Data Center, Asheville, NC 28801). *Journal of Applied Meteorology;* **23**: No. 6, 950-966(Jun 1984).

A potentially fruitful approach to assessing society's sensitivity to climate change is to study the impacts, perceptions and adjustments of recent climate fluctuations. We set out to determine if the recent (1931-82) United States climate record exhibits fluctuations of sufficient scope and magnitude to be useful in a complement of retrospective, empirical studies of climate impacts. The search for fluctuations was designed specifically to identify areas and periods in which the climate within an epoch was terminated by a rather sharp transition to another epoch with a climate unlike the previous epoch. The largest 10- to 20-year temperature and precipitation climate fluctuations are identified across the contiguous United States, along with various scenarios of simultaneous change of temperature and precipitation for the four seasons and annually. All possible 10- to 20-year nonoverlapping "consecutive epochs" within 344 state climatic divisions (as defined by the National Climatic Data Center) were examined for the greatest temporal differences of temperature and precipitation. Additionally, large spatial gradients of climate fluctuations of opposite sign have been identified across climate divisions within short distances of each other (< 750 km). The climate fluctuations were specifically identified for the purpose of studying and modling climate impacts, but they are also of general interest to researchers investigating the physical behavior of climate across the United States.

5297 **Wind direction meander at a coastal site during onshore flows.** Raynor, G.S.; Hayes, J.V. (Atmospheric Sciences Division, Department of Applied Science, Brookhaven National Laboratory, Upton, NY 11973). *Journal of Applied Meteorology;* **23**: No. 6, 967-989(Jun 1984). Contract AC02-76CH00016.

About 700 cases of wind direction meander occurred in a three-year period during onshore flow at a Long Island coastal site. Most appeared to be caused by internal gravity waves but some by roll vortices. Each case was documented with respect to data, time, wind speed, wind direction and stability, and described by duration, number of waves, angular amplitude and period. Hourly wind data for the same years were examined to determine the frequency of onshore flows.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5002004199, 4210, 4211, 4261, 4292, 4303, 4363, 4786, 5068, 5117, 5353, 5354, 5389, 5392, 5405, 5435, 5534, 5542, 5543

5298 **(BNL—34372) Correlation analysis of long term trends in air pollution emissions concerning air quality and precipitation chemistry in the northeastern United States.** Lipfert, F.W.; Daum, M.L. (Brookhaven National Lab., Upton, NY (USA)). 1983. Contract AC02-76CH00016. 21p. (CONF-8308137—2). NTIS, PC A02. File Number DE85003500.

From CACGP symposium on trospospheric chemistry; Oxford, England (28 Aug 1983).

Trends in precipitation chemistry, air quality and precursor pollutant emissions were analyzed and used to develop and test hypotheses concerning atmospheric chemistry relationships. A consistent linear relationship was found between NO/sub x/ emissions and NO_3 in rain. There is also a relationship between NO/sub x/ emissions and reduced atmospheric visibility during spring and summer. This may reflect an impact through photochemical cycles. For SO/sub x/, the most consistent findings relate to ammonium in precipitation, which may reflect ammonium aerosol scavenging. Changes in atmospheric visibility are not strongly linked to ammonium content in rain. SO_3 emissions are not associated with SO_4 in precipitation, although associations were found between SO_2 emissions and reduced visibility, for winter and summer seasons. 12 figures, 2 tables. (MF)

5299 (BNL—51542, pp 18-25) **Estimating health risks of air pollution at the national level.** Rowe, M.D. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

Health risks of air pollution from energy production are highly location specific, but estimates of future emissions from such sources are often not location specific. A method is presented for estimating health risks from future emissions sources when estimates of locations of sources are not available. The method is based on results of complex, location-specific computer simulations of long-range transport and transformation of pollution emissions generalized to the national or regional level as probability distributions of exposures or health risks. Details are shown for long-range transport of non-sulfate respirable particles from coal-fired power plants and residential coal furnaces.

5300 **(CONF-831048—4) Atmospheric CO_2 projections with globally averaged models.** Trabalka, J.R.; Emanuel, W.R.; Gardner, R.H.; Reichle, D.E.; Edmonds, J.; Reilly, J.; Moore, B. III. (Oak Ridge National Lab., TN (USA); Institute for Energy Analysis, Washington, DC (USA); New Hampshire Univ., Durham (USA)). 1983. Contract AC05-84OR21400. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85002323.

From Global carbon cycle - analysis of the natural cycle and implications of anthropogenic alterations for the next century; Knoxville, TN, USA (31 Oct 1983).

The consequences of an anticipated increase in atmospheric CO_2 concentrations from the combustion of fossil fuels and other anthropogenic activities cannot be adequately evaluated without realistic estimates of future CO_2 levels. Historic fossil fuel usage to the present, growing at a rate of 4.5% per year until 1973 and at a slower rate of 1.9% after 1973, is projected at rates of approximately 0.2 to 2.8% per year from 1975 until 2075 using an energy-economic model. Varying key parameters within the bounds of currently expected future values is used to provide bounds on CO_2 emissions projections. Atmospheric CO_2 emissions in the year 2075 are thereby projected to be in the range of 6.6×10^{15} to 91×10^{15} g C $year^{-1}$. Annual CO_2 emissions data were used as inputs to two different global carbon cycle models. Carbon cycle model simulations used a range of year-1860 preindustrial atmospheric concentrations of 245 to 292 ppMv CO_2 based on three scenarios of biosphere conversion as additional atmospheric CO_2 source terms. These simulations yield a range of possible atmospheric CO_2 concentrations in year 2075 of from approximately 500 to 1550 ppMv, with a median of about 700 ppMv. The estimated time at which atmospheric CO_2 doubles the preindustrial level ranges from year 2025 to >2075. This forecast exercise forces quantitative definition of the assumptions and uncertainties in the global CO_2 budget. These terms form the basis of our understanding of the natural biogeochemical cycle of carbon as well as both past and future human influences on the dynamics of the global cycle. 51 references, 10 figures, 6 tables.

5301 **(CONF-8307133—1) Transport of binary mixtures of trace contaminants through an adsorber bed.** Modey, R.; Huang, J.C.; Rothstein, D.; Wu, B.G. (Kent State Univ., OH (USA). Dept. of Physics). 1983. Contract AC02-80ER10622. 10p. NTIS, PC A02. File Number DE84016510.

From 13. intersociety conference on environmental systems; San Francisco, CA, USA (11 Jul 1983).

A second-order partial differential equation governs the transport of an adsorbate through a porous medium. The gas-phase concentration and the solid-phase concentration parameters were studied in the case of a binary mixture of gases. 22 references, 9 figures. (ACR)

5302 **(CONF-8403150—3) Report of the Instrumentation Panel on future research needs.** Vo-Dinh, T.; Hawthorne, A.R.; Doemeny, L.J.; Gouw, T.H.; Satterfield, R.; Stetter, J.R. (Argonne National Lab., IL (USA); Chevron Research Co., Richmond, CA (USA); Technology for Energy Corp., Knoxville, TN (USA); National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002299.

From DOE-OHER workshop on monitoring and dosimetry in an occupational health research program for synfuel technologies; Knoxville, TN, USA (20 Mar 1984).

This report outlines the recommendations of the Instrumentation Panel for future instrumentation research needs in an Occupational Health Research (OHR) Program for synfuel technology. Current monitoring technology is inadequate to evaluate the occupational health impacts associated with new energy technologies, particularly synthetic fuels. Of the many possible areas of potentially fruitful research, this Panel has identified five major research areas that are essential to provide adequate tools for assessing the exposure and protecting the health of workers in synfuel facilities. These are: (1) development of monitoring tools for polynuclear aromatic compounds; (2) development of skin contamination monitors; (3) development of biological monitors; (4) development of aerosol/particulate monitors and sampling instrumentation; and (5) sensor technology development. (ACR)

5303 **(DOE/ER/60106—1) Lake ice occurrence as a possible detector of atmospheric CO_2 effects on climate. Progress report, December 1, 1983-November 30, 1984.** Barry, R.G. (Colorado Univ., Boulder (USA). Cooperative Inst. for Research in Environmental Sciences). Nov 1984. Contract AC02-83ER60106. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002951.

Temporal patterns of the freeze-up and break-up of lakes in middle and high latitudes have been analyzed to determine the usefulness of such data as an integrative index of thermal trends that are expected as a result of CO_2 induced climatic effects. High correlations exist between daily mean air temperatures during approximately 80 days prior to these events and the freeze-up/break-up dates, confirming the value of lake ice data as an index of thermal regime during the transition seasons. A change in freeze-up date of +- 6 (+- 4) days corresponds to a +- 1°C temperature change. Break-up dates show lower correlations although decadal averages show greater coherence than for freeze-up. A spatial array of lake-ice conditions monitored by satellite could serve as a useful tool for early detection of possible CO_2-induced perturbations.

5304 **(DOE/EV/10631—T1) Earthscan press briefing programme on carbon dioxide, climate and energy. Final report.** (Earthscan, London (UK); International Inst. for Environment and Development, London (UK)). 1982. Contract FG01-81EV10631. 154p. (In several languages). NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85000387.

The purpose was to give journalists an intensive briefing on the complex issue of carbon dioxide and its relation to energy. The report includes presentations on the basic science of the carbon cycle, the climatic effects of rising CO_2, how the regional climatic effects would impact on agriculture, US and global energy policies, and recommendations for medium-term energy strategies. Individual items within the scope of EDB have been entered into the data base. (ACR)

5305 (EPRI-EL—3581, pp 4.59-4.69) **Innovative design concepts for prevention of airborne PCB contamination.** West, B.W.; Hansen, W.G.; Fenner, W.A. (West and Hansen Engineers, Inc., Long Beach, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Within the past several years, failure of electrical equipment filled with polychlorinated biphenyl (PCB)-bearing dielectric fluids has resulted in extensive contamination of buildings in Binghamton, NY (1981); San Francisco, CA (1983) and other locations. The magnitude of these incidents was a result of air-spills of atomized PCBs and combustion byproducts of the dielectric fluids (furans and dioxins). Resultant cleanup costs and potential liabilities associated with these types of incidents and materials can easily run into the millions of dollars. Prior to the Binghamton incident, the potential for airborne contamination was little appreciated, with the result that the scope of other past incidents can only be estimated. Surveys and design projects for seven California and Washington State agencies were completed identifying potential sites where airborne contamination might occur and cost-effective methods were devised for isolating PCB equipment. Structures surveyed included office buildings, schools, hospitals, highway bridges and tunnels. Both transformers and capacitors were involved. Some of the design techniques used to prevent widespread structure contamination are presented. These procedures include modification of ventilation systems, partitioning of mechanical and electrical areas in utility rooms, closed heat exchangers for air-to-air equipment cooling and automatic fan shutdown devices. Considering the amount of utility and customer-owned PCB equipment in occupied structures throughout the country, it is probable that future airborne PCB contamination will occur. Identification and isolation of high-risk equipment installations can significantly reduce potential liabilities, health effects and property impairment caused by such episodes.

5306 **(IC—83/194) Diffusion of pollutants in the atmospheric Ekman boundary layer.** Obada, A.S.F.; Mayhoup, A.B. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780099.

A model for the pollutants diffusion in the lowest kilometers of the atmosphere, the planetary boundary layer, has been established. In this boundary layer, the vertical gradients of the physical quantities are much larger than the horizontal gradients and the viscosity is important and comparable in magnitude to the pressure gradient and Coriolis forces. The velocity profiles in the layer are derived from Ekman layer equations. The partial differential equa-

tion of second order that governing the transport and diffusion of contaminants emitted from an area source has been solved.

5307 **(IVL-B—750) Effects on health by the emissions from iron and steel industry to the atmosphere. Progress report 1. Emission data and the toxicity of emitted metals.** Wiklund, L.; Fischer, S.; Svensson, A.; Cederberg, I. (Institutet foer Vatten- och Luftvaardsforskning, Stockholm (Sweden)). Mar 1984. 115p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750222.

The availability of data is limited and the surveys are often absolute. A comparison is made between the emissions from 1977/78 and 1981/82. Large point sources are presented. Increased contents of Cr, Mn, Fe, Pb, Cd, Ni, As, V, Co, Mo, Cu and Zn have been reported. Increasing So_2, PAH and H_2S are noted. Some critical concentrations including toxic effects have been observed.(L.E.).

5308 **(LIS—27) Air pollution control. Apparatus for quality control of immission measurements (AQIM).** Manns, H.; Gies, H.; Nitz, H. (Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)). Dec 1982. 139p. (In German). Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.).

Interlaboratory tests and comparative measurements are well suited to improve the state of knowledge and skill in connection with the analytical-chemical measurement methods for the purpose of maintaining quality of ambient air measurements by improving dependability and comparability of measuring procedures. For the execution of interlaboratory tests and comparative measurements with ambient-air measuring procedures (immission measurements) a sample air manifold has been developed, which can furnish about 30 participants simultaneously with a measuring gas. This apparatus has served with good success for comparative measurements on a national as well as international scale with procedures for benzene, toluene, xylene, vinyl chloride, nitrogen monoxide, nitrogen dioxide, and sulfur dioxide. Sampling of aromatic hydrocarbons by sorption on Tenax GC with the temperature gradient tube method has been investigated and process conditions to avoid decay of Tenax GC were improved. Suggestions for a simplified modification of aromatics sampling on Tenax GC are presented.

5309 **(N—84-27336) Stratospheric concentration of nitric acid, ozone and sulphurous carbonyl: measurement of nitric acid absorption in the Q branch of the V4 band as a function of temperature.** Leboiteux, S. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 75 - Paris (France)). 1982. 146p. (AD-B—071596; ONERA-NT—1982-7). NTIS, PC A07/MF A01.

Ten stratospheric species (O_3, NO_2, OCS, NO, CH_4, N_2O, HCl, HF, CO, HNO_3, and H_2O were simultaneously measured and infrared absorption measurements by HNO3 were recorded by instruments on a Caravelle aircraft and from a balloon platform. The spectra obtained are presented and an attempt is made to evaluate a temperature dependence correction for the atmospheric spectra.

5310 **(N—84-27340) Experimental and theoretical study of NOx by reduction by NHi in gas phase.** Boettner, J.C.; James, H. (Centre National de la Recherche Scientifique, 45 - Orleans-la-Source (France). Centre de Recherches sur la Chimie de Combustion et des Hautes Temperatures). 1983. 7p. (In French). NTIS, PC A02/MF A01.

It is shown that NH_2 radicals can be produced by adding NH_3 to a CO/O_2 reaction at temperatures between 700 and 900 C. The NH_2 radicals react mostly with the NO present and provoke a second branch of the mechanism which accelerates NOx destruction. The reaction is advocated as a means of reducing air pollution caused by burning coal and coal tar. (ESA)

5311 **(N—84-28268) Basic mathematical formulation of the contaminant dispersion processes.** Valenzuela, M.M. (Instituto Nacional de Tecnica Aerospacial, Madrid (Spain)). 1983. 4p. (In Spanish). NTIS, PC A02/MF A01.

Mathematical formulations of contaminant dispersion processes are provided. Three major areas of atmospheric contamination phenomena are considered: mechanisms of the generation of contaminants, mechanisms of dispersion, and processes of natural elimination. The economic, social, and legislative aspects of atmospheric contamination are discussed. Major advances have been made in controlling and reducing atmospheric pollution, but many phenomena still are poorly understood. The atmospheric dispersion of contaminated effluents is studied using fluid dynamics equations.

5312 **(N—84-28269) Analysis of metals in atmospheric particles for spectrophotometry of atomic absorption.** Garriga, R.D. (Instituto Quimico de Sarria, Barcelona (Spain)). Oct 1982. 140p. (In Spanish). NTIS, PC A07/MF A01.

The nature of the atmosphere, properties and transport of major contaminants, the effect of air pollution on health, ecology, and the economy, and means of controlling air pollution are discussed. Various methods used to combat solid atmospheric particles, sediments, and suspensions were analyzed. Heavy metals were measured by atomic absorption, hydrocarbons were measured using infrared spectrophotometry and insoluble residues in acids of sediment particles were characterized. Some 14 samples of sediment particles from Sam Adrian del Besos were analyzed for organic and mineral fractions, heavy metals, and hydrocarbons. The Fe, Pb, Zn, Mn, Cu and hydrocarbon content of five suspension particle samples from a smelter in the same city also was investigated.

5313 **(N—84-28274) Basic mathematical formulation of contaminant dispersions.** Valenzuela, M.M. (Instituto Nacional de Tecnica Aerospacial Esteban Terradas, Torrejon de Ardoz (Spain). Lab. Combustion y Contaminacion). 1983. 5p. (In Spanish). NTIS, PC A02/MF A01.

A mathematical expression is obtained by uncoupling the contaminants conservation equation from the rest of equations governing the motion and the thermodynamic state of the fluid. The variables involved include the turbulent velocity components, the molecular diffusion coefficients, chemical reaction effects and the instantaneous concentration of a contaminant. It is recognized that a complete simulation model requires a large amount of data on the physical parameters governing the processes. (ESA)

5314 **(NP—5770106) Dynamic model of the natural carbon cycle and its alteration by human influences.** Kratz, G. (Frankfurt Univ. (Germany, F.R.). Fachbereich Chemie). 4 Nov 1983. 325p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE85770106.

The ocean is represented by a model with two oceanic regions that can be separated alternatively by the 40th, 50th or 60th parallel N and S. The topography of both regions is defined by the hypsographic curve of Menard and Smith, 1966. Cold, polar surface water sinks down, propagates horizontally into the oceanic abyss of the lower latitudes as described by a depth-dependent function, and swells up. Different, depth-dependent diffusions are assumed for the two regions, and the sinking and depth-dependent decomposition of biogenic materials are modelled. Apart from the oceanic surface circulation, there is a net carbon flow from the hot surface water to the cold via the atmosphere, due to the fact that the CO_2 partial pressure in the surface layer of the lower latitudes is higher than the atmospheric pressure which, in turn, is higher than the partial pressure in the surface layer of the higher latitudes. Further, a biota model is presented (i.e. a modification of the model of Kohlmaier et al., 1981) with 5 biomass (tropical and non-tropical forests and grasslands, deserts) in which the living phytomass of the forests is represented by 20 compartments each in order to facilitate the simulation of growth dynamics. Various types of human influence are modelled (shifting cultivation, increasing permanent cultivation, commercial land clearing) as well as unintentional forest fires and the process of desertification. The consequences of C emissions from fossil fuels are discussed on the basis of various scenarios of fossil-fuel consumption.

5315 **(ORNL/TM—8652) Multiple-pathways screening-level assessment of a hazardous waste incineration facility.** Holton, G.A.; Travis, C.C.; Etnier, E.L.; O'Donnell, F.R.; Hetrick, D.M.; Dixon, E. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000156.

The purpose of this assessment was to make a preliminary determination of the relative importance of air, food, and water pathways to human exposure from hazardous materials released from incineration facilities. These results are to be used to determine where more research on food and water pathways may be warranted. Identical 150 x 10^6 Btu/h rotary kiln incinerator facilities burning pesticide-related wastes were assumed to be sited in three different locations in the United States. The locations studied for air and food chain exposures were a southern California site (S-1) at 33° 20′ latitude and 115° 30′ longitude; a northern Midwest site (S-2) at 44° 55′ latitude and 89° 50′ longitude, and a central Midwest site (S-3) at 38° 20′ latitude and 94° 20′ longitude. These sites are in areas that lead the nation in production of leafy vegetables, milk, and beef, respectively, and were chosen to estimate possible worst-case population exposures from these foodstuffs. In the water pathways assessments, screening-level assessments were performed at sites S-1 and S-2. Major conclusions of this report are: for certain organic chemicals the food chain pathway may be an important contributor to total human exposure from incineration of hazardous wastes; for trichloroethylene, the drinking water pathway appears to be a small contributor to total human dose. The present assessment did not determine human exposure from chemicals leached into groundwater after release from a hazardous waste incinerator. 40 references, 19 tables.

5316 **(PB—84-203512) Regional Air Pollution Study (RAPS) 1976 hourly area source emissions (CDC format), January 1-21, 1976. Data file.** Busse, A.; Novak, J.H. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). 1976. mag tapep. Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation PB-293 164, PB-249 613, PB-250 113 and PB-250 114.

The St. Louis Regional Air Pollution Study (RAPS), provided a comprehensive documentation of regional air quality, meteorology and pollutant emissions. RAPS involved an average data collection rate in excess of one million observations per day over a 3 year period (1974-1977). The overall objective of the Regional Air Pollution Study (RAPS) was to create a comprehensive research data set to be used in the development, evaluation and validation of Air Quality Simulation Models. The RAPS 1976 hourly area source emissions data are contained on a series of six IBM binary or eighteen CDC binary tapes. Hourly emissions of the criteria pollutants (1) total suspended particulate, (2) sulfur dioxide, (3) nitrogen oxide, (4) total hydrocarbons (5) carbon monoxide, as well as fugitive dust and the breakdown of total hydrocarbon into moles of nonreactive hydrocarbon, paraffins, olefins, aromatics and aldehydes are reported for 1989 RAPS grids varying in size from 1 square kilometer to 100 square kilometers. The gridded area covers Air Quality Control Region (AQCR) 70 in entirety. The reported hourly data combines several major categories of area source emissions: river vessels, fugitive dust, highways, railroads, stationary residential and commercial, off-highway mobile, stationary industrial sources and airports. The stationary industrial source category contains the minor point sources emitting less than 0.01% of a given pollutant. The complimentary hourly point source data is available on another series of tapes. State-of-the-art emission inventory methodologies in 1976 were used to provide much of the temporal and spatial resolution required for use in Air Quality Simulation Models. The first file on each tape contains file formats and record layouts. The second file on each tape contains grid descriptions; thus each tape may be accessed independently. This tape covers the time period of January 1-21, 197.

5317 **(PB—84-233592) Influence of wind on the dust emission from a municipal refuse incinerator.** Lee, B.E. (Sheffield Univ. (UK). Dept. of Building Science). Nov 1982. 18p. (BS—71). NTIS, PC E03/MF E03.

The municipal refuse incinerator operated by the City of Sheffield authorities consumes 80% of the domestic refuse for an urban conurbation of 600,000 people, the heat generated supplying a high rise development of 2300 dwellings with space heating and hot water services. The operational problem which arises during the vehicle tipping operation is that in windy conditions dust, fly ash and small particles from the refuse build up in the area above the pit and in the tipping stalls. Since the operators stand at the sides of their vehicles in the tipping stalls during the tipping operations they are personally subject to the health hazard imposed by the dust problem with its attendant difficulty of reduced visibility. Labor problems have resulted from this dust exposure to the extent that drivers refuse to tip in windy conditions, hence the incinerator has to be shut down with the accompanying loss of heating revenue. It should be pointed out that although the plant design includes dust extraction equipment fitted both in the tipping stalls and above the refuse pit that this equipment is not effective in preventing dust movement in windy conditions. An investigation of the problem has been carried out and some recommendations have been made whose fulfilment should reduce the severity of the problem where unfortunately the most successful solution is also the most expensive.

5318 **(PB—84-241637) Control technology assessment of hazardous waste disposal operations in chemicals manufacturing: walk-through survey report of Olin Chemicals Group, Charleston, Tennessee.** Crandall, M.S. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1983. 13p. (CT—103-20). NTIS, PC A02/MF A01.

A walk through survey was conducted to assess control technology for hazardous wastes disposal operations at Olin Chemicals Group (SIC-2800, SIC-2812, SIC-2819), Charleston, Tennessee in May 1982. Hazardous wastes generated at the facility included brine sludge, thick mercury (7439954) (Hg) butter, and calcium-hypochlorite (7778543). An estimated 8500 tons of waste were disposed of annually. The Hg waste underwent a retorting process that recycled the Hg. The final detoxified waste was land filled. Brine sludge and calcium-hypochlorite were also land filled. No controls beyond those normally used at such sites were found at the landfills. Periodic monitoring of Hg vapor concentrations was conducted by the company. Medical monitoring of urine for Hg exposure was conducted. Specific limits were set for urinary Hg concentrations. When these limits were exceeded the workers were removed from exposure. Personal protective equipment consisted of hard hats, safety glasses, and spirators specially designed for Hg exposure. The author concludes that the hazardous waste disposal and treatment operations at the facility are well controlled.

5319 **(PB—84-241793) Health hazard evaluation report No. HHE-75-046, General Services Administration, Marion, Ohio and Fort Wayne, Indiana depots.** Price, J.H.; Seta, J.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 12 Sep 1975. 22p. (HHE—75-046). NTIS, PC A02/MF A01.

Surveys were conducted at the General Services Administration (SIC-4225) depots in Marion, Ohio and Fort Wayne, Indiana, on June 2 and 3, 1975. A total of 27 atmospheric samples were collected to determine the airborne concentrations of asbestos (1332214) fiber in various warehouses and during handling operations. Personal samples were taken to determine employee exposures, and area samples were collected to determine concentrations in warehouses with minimal activity. Samples collected in warehouses with little activity were below the limits of detection for asbestos. Vacuuming and repairing of asbestos filled bags were the most hazardous operations, with values above the proposed OSHA standard of two fibers per cubic centimeter. At the Marion depot, the checker's exposure was close to the proposed standard. Samples collected in the Fort Wayne depot were well below the standard. The authors recommend the use of protective clothing, respirators, and medical surveillance for all workers exposed to asbestos, with chest X-rays and pulmonary function tests to be performed every 2 years.

5320 **(PB—84-241892) Walk-through survey: Stackpole Corporation, St. Mary's, Pennsylvania.** Greife, A.; Ward, E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). 1983. 13p. NTIS, PC A02/MF A01.

A walk through survey was conducted at Stackpole Corporation (SIC-3624), Saint Mary's, Pennsylvania in March 1982 to gather data concerning the feasibility of including the facility in an industrywide survey of the carbon products industry. The company

produced a variety of products utilizing petroleum coke, coal-tar-pitch, and petroleum pitch. Engineering controls and employee records were inspected. The engineering controls consisted of a ventilation system installed over the tunnel furnaces, dust collection systems in the machining areas, and the use of car bottom kilns on some furnaces. Personnel records were available dating back for about 80 years. The company had a limited industrial hygiene and safety program that included review of all accidents, the issuance of recommendations for improved safe work practices, and maintenance of fire fighting equipment. The authors recommend that employee exposure to polyaromatic hydrocarbons be evaluated in the impregnation operation and around the rotary mixers. Ventilation equipment on all tunnel furnaces should be maintained in good working order. The facility meets the criteria for inclusion in the industrywide survey; however, the survey will not be conducted at the present time due to the small cohort size.

5321 **(PB—84-242049) Evaluation of OSHA (Occupational Safety and Health Administration) method No. 30 for ethylene oxide in air with 400-mg/200-mg charcoal tubes.** Tucker, S.P.; Arnold, J.E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Physical Sciences and Engineering). Feb 1984. 17p. NTIS, PC A02/MF A01.

An analytical procedure based on OSHA method Number 30 for the determination of ethylene-oxide (75218) (EO) was described. The method utilized sampling tubes containing 400 milligrams (mg) of charcoal in the front section and 200mg in the back sections instead of 100mg in the front and 50mg in the rear as in the OSHA method. This solution converted EO to 2-bromoethanol (540512). One microliter of the sample solution was injected into a gas chromatograph equipped with an electron capture detector along with standards prepared from 2-bromoethanol. Charcoal samples that had been obtained from EO in humid air were stored at room temperature and under refrigeration for up to 28 days before being analyzed. EO migrated from the front sections of the charcoal to the back sections during storage. The authors note that EO at concentrations of 0.027 to at least 1.7 parts per million in 5 liter air samples can be determined.

5322 **(PB—84-242577) Control technology assessment of hazardous waste disposal operations in chemicals manufacturing: in-depth survey report of E. I. Du Pont de Nemours and Company, Chambers Works incinerator, Deepwater, New Jersey.** Anastas, M.Y. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1984. 44p. (CT—103-15B). NTIS, PC A03/MF A01.

See also PB84-242569.

An in depth survey was conducted to assess control technology of hazardous waste disposal operations at the Chamber Works incinerator, Du Pont de Nemours and Company (SIC-2800), Deepwater, New Jersey, in October 1982. Area and breathing zone samples were analyzed for toluene (108883), ortho-chloronitrobenzene (88733), and para-chloronitrobenzene (100005). All concentrations were well below the relevant standards. Control and safety instrumentation consisted of an electrically operated interlock system that sensed process disturbances and shut down the furnace. Wastes were burned directly from .ank trailers. Trailer vents were connected to a spot scrubbing system. The hose connections included a recirculation line that prevented the plugging of process and trailer discharge lines with dirt particles. Waste pumps were provided with explosion proof motors and double mechanical seals. The company had programs for worker education and evaluation of on the job performance. Air monitoring of selected air contaminants was done routinely. Minimum protective equipment required for working in the incinerator area included rubber gloves, hard hat, and butyl rubber covers for shoes. The author concludes that a state of the art hazard control system is in place at the facility.

5323 **(PB—84-243039) Control technology for solid materials handling: walk-through survey report of GNB Batteries, St. Paul, Minnesota.** Heitbrink, W.A. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Mar 1984. 8p. (CT—144-20). NTIS, PC A02/MF A01.

A walk through survey was conducted at GNB Batteries (SIC-3069) in Saint Paul, Minnesota, on August 23, 1983. The survey was conducted as part of a study of dust control during bag opening, dumping, and disposal. The facility employed six persons and was built in 1971. The operation of the automatic bag opener in use at the facility was observed. The device was installed to open bags of carbon-black (1333864) and barium-sulfate (7727437). Potential hazards included: exposure to numerous dust emission sources from dust on the outside of bags; bag handling, opening, emptying, and disposal; and equipment malfunction. The author concludes that the automatic bag opener generally controlled the dust generated by bag opening, emptying, and disposal. Worker exposures to dust are increased when bags do not come off the conveyor and have to be removed by hand. A study of a modified automatic bag opener is recommended.

5324 **(PB—84-243179) Control technology assessment of hazardous waste disposal operations in chemicals manufacturing: walk-through survey report of Chemical Waste Management, Inc., Emelle, Alabama.** Anastas, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Aug 1982. 13p. (CT—103-16A). NTIS, PC A02/MF A01.

A walk through survey was conducted to assess hazardous waste disposal operations at Chemical Waste Management, Incorporated (SIC-4953), Emelle, Alabama in February 1982. Hazardous waste treatment and disposal operations included landfilling, fixation, solar evaporation, and incineration. The incinerator was a liquid injection unit used for combustible liquids containing up to 10 percent chlorine. Polychlorinated biphenyls and other chlorine containing wastes not treated on site were temporarily stored before shipment for at sea incineration. In-situ fixation was carried out on corrosive, acidic, and heavy metal containing liquids. Liquid wastes were removed and eventually pumped into a pit where they were mixed with cement kiln dust. Drum stored wastes intended for landfilling were transported by front end loaders to the site. Heavy equipment operators were protected from exposure to dust by environmental cabs. Air and medical monitoring were performed on landfill, laboratory, and maintenance shop workers. Hard hats, goggles, and safety shoes were required at the landfill. Respirators and other protective equipment and clothing were available. The author concludes that the company management is concerned about the health and safety of the employees. An in depth survey is recommended.

5325 **(SNV-PM—1628) Measurements of the contents of heavy metals in Oerebro.** Andersson, K.; Steen, B.; Oeblad, M. (Statens Naturvaardsverk, Solna (Sweden)). 1982. 75p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750217.

The mass concentration of particle borne metals in air was determined in central Oerebro using two different techniques. One included high-volume samplers with cascade impactors plus analysis with atomic absorption. The other included dichotomous samplers and X-ray flourescense. The measurements were performed during March to August, 1981, in roof as well as in street level. Analysis were made for As, Be, Cd, Cr, Fe, Mn, Ni, Pb, V, total particle mass, sulfate and nitrate. Size fractions used were 0-2.5 μm, 2.5-15 μm and >15 μm aerodynamic diameter. SO_2- and NO_2-concentrations were also determined. In comparing the results obtained with results from other measurements it is seen that the metal concentrations in Oerebro are low but normal for a city of its size and character.

5326 (ZfI-Mitt—80, pp 56) **Investigation of the relationship of the deuterium concentration between the atmospheric water vapor and precipitation around the Schirmacher oasis (East Antarctica).** Kowski, P. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5327 (Zfl-Mitt—80, pp 59) **Carbon 13 in atmospheric CO_2: 1977-1981.** Mook, W.G. (Rijksuniversiteit Groningen (Netherlands). Centraal Isotopen Lab.); Keeling, C.D. (Scripps Institution of Oceanography, La Jolla, CA (USA)). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5328 (Zfl-Mitt—80, pp 92-93) **Deuterium and oxygen-18 in water vapour and precipitation: application to atmospheric water vapour transport and to paleoclimate.** Sonntag, C.; Schoch, H.; Rozanski, K.; Rudolph, J. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Umweltphysik). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5329 **Seasonal variations in ambient atmospheric levels of formaldehyde and acetaldehyde.** Tanner, R.L.; Meng, Z. (Brookhaven National Lab., Upton, NY). *Environmental Science and Technology;* **18**: No. 9, 723-726(Sep 1984). Contract AC02-76CH00016.

A simple technique is described for determining ambient atmospheric levels of formaldehyde and acetaldehyde by using impinger collection in acidified 2,4-dinitrophenyl-hydrazine/acetonitrile solution and direct high-pressure liquid chromatography with UV absorbance detection of the corresponding phenylhydrazone solution on reversed-phase columns. A limit of detection of ~ 1 ppb for 1-h impinger collections is obtained. Data from a coastal NE US site show no discernible diurnal trends, but strong seasonal variations in the levels of both aldehydes are observed, with summer maxima and winter minima. Formaldehyde/acetaldehyde ratios are relatively high (>4) in winter and spring and low (<2) in summer and fall.

5330 **Formaldehyde release from selected consumer products: influence of chamber loading, multiple products, relative humidity, and temperature.** Pickrell, J.A.; Griffis, L.C.; Mokler, B.V.; Kanapilly, G.M.; Hobbs, C.H. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM). *Environmental Science and Technology;* **18**: No. 9, 682-686(Sep 1984). Contract AC04-76EV01013.

Formaldehyde release rates were measured for one sample each of a variety of consumer products under various conditions of temperature, humidity, and mass loading in a ventilated chamber. The rate of formaldehyde released from pressed wood products was much greater than from insulation material or carpeting, whether measured in a dynamic (ventilated) or static (nonventilated) chamber. Formaldehyde was released from wood products at a more rapid rate when chamber loadings (product surface area/chamber volume) and chamber concentrations of formaldehyde were reduced. Formaldehyde release from particle board and plywood was not substantially affected by the different temperatures (25-35°C) and humidities (40-90%) tested. When particle board was paired with plywood, insulation, or carpet, the formaldehyde released was less than the sum of that released when each product was tested alone. These data suggest that these samples of plywood, insulation, or carpet (slow releasers of formaldehyde) absorbed formaldehyde released from the higher emitting particle board. Consequently, the surface area of carpet, insulation, and/or wood in a ventilated room relative to that of pressed wood products may be an important determinant of formaldehyde concentrations in the air of that room.

5331 **Acid rain: implications for fossil R and D. Hearings before the Subcommittee on Energy Development and Applications and the Subcommittee on Natural Resources, Agriculture Research and Environment of the Committee on Science and Technology, US House of Representatives, Ninety-Eighth Congress, First Session, September 13, 20, 1983.** Washington, DC, USA; Government Printing Office (1984). 1287p.

Expert testimony from research institutes, industry, and from DOE and the Environmental Protection Agency on the status of current knowledge about acid rain focus on research programs and the development of cost-effective control technologies. The testimony includes a report from the national acid precipitation assessment program. Despite a general agreement that the sulfur and nitrogen emissions in Eastern North America are manmade and are responsible for some of the effects of acid rain, not enough is known to develop a good mitigating strategy. Witnesses describe control programs used by the Tennessee Valley Authority, work in progress at the Electric Power Research Institute, and the difficulty of predicting environmental effects in one region that are caused by pollution sources from another region. Two appendices with additional questions and answers and material submitted for the record follow the testimony of the seven witnesses.

5332 **Determining the inhibition constants in the HCH-1 model of cellulose hydrolysis.** Holtzapple, M.T.; Caram, H.S.; Humphrey, A.E. (Army Natick R & D Laboratories, MA). *Biotechnology and Bioengineering;* **26**: No. 7, 753-757(1984). Contract AC02-76ET20025.

The products of cellulose hydrolysis, glucose and cellobiose, caused noncompetitive inhibition patterns to be exhibited when Thermomonospora sp. YX cellulase hydrolyzed dyed cellulose. The glucose binding constant, β_1, was 0.00683 +/- 0.00031 L/g and the cellobiose binding constant, β_2, was 0.095 +/- 0.0058 L/g. Thus, cellobiose was about 14 times more inhibitory than glucose.

5333 **Evidence for the long-distance atmospheric transport of polychlorinated terphenyl.** Wingender, R.J.; Williams, R.M. (Argonne National Lab., IL). *Environmental Science and Technology;* **18**: No. 8, 625-628(1984).

The ubiquitous occurrence of polychlorinated biphenyls in the environment is well-known. A class of chemically similar compounds, the polychlorinated terphenyls (PCTs), has also been found, but their routes into the environment and the extent of contamination are not known. Recent sampling from a site location in the middle of Lake Huron indicates that the atmosphere over the lake contains low levels (preliminary work shows levels up to 2 ng/m^3) of PCTs; PCTs were also found in precipitation samples. The detection of PCTs well after their production ceased (~ 1970) suggests that this class of compounds may already be as ubiquitous as PCBs with respect to long-range atmospheric transport.

5334 **Estimates for pollution profiles above finite area-sources.** Horst, T.W.; Slinn, W.G.N. (Pacific Northwest Lab., Richland, WA). *Atmospheric Environment;* **18**: No. 7, 1339-1346(1984).

A theoretical basis is presented for an integral-equation method of describing airborne pollution concentrations above an arbitrary area-source and for arbitrary air-surface exchange. The method is then used to describe concentrations of pesticides above a treated field, and the predicted profiles are used to interpret recently reported data. For this case, different profiles can result from different fetch-dependent source strengths, in turn dictated by each pesticide's air/surface partition coefficient.

5335 **Oxidant requirements for the acidification of precipitation.** Kleinman, L.I. (Brookhaven National Lab., Upton, NY). *Atmospheric Environment;* **18**: No. 7, 1453-1457(1984). Contract AC02-76CH00016.

A simple storm model is used to provide a qualitative estimate of the concentration of oxidant and SO_2 required to produce rainwater with a chemical composition as observed by the MAP3S monitoring network. The essential features of this model are that planetary boundary layer air is pseudo-adiabatically lifted, the chemical composition of the resulting condensed water is assumed to be identical to that observed on the ground, and a fraction of the sulfate found in precipitation is attributed to in-cloud oxidation of SO_2. According to this model, average summer precipitation is stoichiometrically related to a gas phase SO_2 and oxidant concentration of between 3.3 and 4.7 ppb. Possible sources of H_2O_2 are examined.

5336 **Formation of sulfate in a cloud-free environment.** Lee, I.Y. (Argonne National Lab., IL). *Journal of Climate and Applied Meteorology;* **22**: No. 1, 163-170(Jan 1983).

A model of sulfate aerosol growth, containing homogeneous gas kinetics, particle growth by coagulation and heteromolecular diffusion, and solar radiation effects has been developed to examine the microphysical mechanisms associated with clear-air transformation of sulfur dioxide is approximately 1% h^{-1} and that the sulfate particles produced by clear-air oxidation processes evolve to give a spectrum with an active mode at 0.03 μm radius. The oxidation of sulfur dioxide undergoes a diurnal variation in response to the diurnal solar cycle. The transformation rate of sulfur dioxide increases as atmospheric opacity decreases and the number density of sulfate particles increases with increasing atmospheric humidity.

5337 **Use of factor analysis in source determination of particulate emissions.** Severin, K.G.; Roscoe, B.A.; Hopke, P.K. (Univ. of Illinois, Urbana). *Particulate Science and Technology;* **1**: 183-192(1983). Contract AC02-80EV10403.

The development of multivariate statistical approaches to receptor models have focussed on factor analysis. Target transformation factor analysis (TTFA) offers the possibility of determining the number of sources and their elemental composition as well as their mass contributions. In this current work, a new approach is presented for calculating the mass contributions of each source to each sample. In addition an approach to estimating the uncertainties in the analysis is introduced. The method is applied to a subset of the Regional Air Pollution Study (RAPS) particulate composition data set for site 103 in July and August 1976. The data is divided into subsets covering the daylight (6 am to pm) or night (6 pm to 6 am) samples. Similar source profiles are obtained for these subsets.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5003004363, 4757, 5209, 5210, 5214, 5219, 5234, 5235, 5236, 5291, 5292, 5494, 5561

5338 **(CNEN-DIN—02/82) Wind directing correlation and vertical temperature gradient correlation with the wind direction amplitude variation at Angra dos Reis site.** Nicolli, D. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro. Dept. de Instalacoes e Materiais Nucleares). Aug 1982. 66p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780204.

Two studies are presented: an analysis of air flow characteristics at the Itaorna site, in Angra dos Reis by correlation of wind directions measured simultaneously on four meteorological masts, and a tentative correlation of vertical temperature gradient with the wind fluctuation standard deviation. It's concluded that the wind directions change vertical and horizontally and the wind direction fluctuation amplitude holds no correlation with the vertical temperature gradient, and therefore it should not be used as an alternative for determination of stability categories.

5339 (FS—83-30-T, pp 325-334) **Emission measurement - state of the art, experience, trends.** Voelkle, H.; Barz, H.G.; Hefner, A. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Microprocessors have initiated enormous progress in the field of radioactivity monitoring. High-sensitivity, nuclide-specific methods of measurement and automatic sampling systems help to detect even minimum concentrations of radionuclides. In consequence, environmental radioactivity is among the best-monitored emissions. Concentration measurements in different media, including the human body, help to establish the fate of radionuclides. Even with fallout levels and emissions from modern nuclear facilities decreasing, emission monitoring in consideration of radiation protection aspects will continue to be indispensable.

5340 (FS—83-30-T, pp 335-343) **Experience with the 'Guideline for Emission and Immission Monitoring in Nuclear Facilities' from the points of view of power plant operators and independent measuring laboratories.** Bentele, W.; Huebel, K.; Kirchhoff, K. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The guideline has, on the whole, had the desired results. Modifications are proposed for: 1. ^{90}Sr measurements in aerosol filters, soils and vegetables should be carried out only if γ spectrometry has shown raised activity levels; fast methods should be developed for routine measurements and accidents. 2. The detection limit of γ nuclides in soil samples should be raised from the present 10 pCi/kg to 50 pCi/kg. 3. The detection limit of α nuclides in aerosol filters should be raised from the present 0.1 fCi/m^3 to 1 fCi/m^3 (reference nuclide: ^{239}Pu). 4. In vegetables, measurements should refer to dry matter instead of fresh matter, and the water content or dry-to-fresh-matter ratio should be indicated. 5. To increase the reliability and applicability of results, measurements should be carried out in laboratories instead of mobile units.

5341 (FS—83-30-T, pp 345-348) **Dose rate meters for environmental monitoring.** Lauterbach, U.; Kirchhoff, K.; Jansen, K. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The authors describe novel system with ionisation chambers, scintillation counters or special counter tubes as detectors and with microprocesor-based data acquisition systems.

5342 (FS—83-30-T, pp 349-352) **Determination of net radiation doses in the environment of nuclear power plants by means of thermoluminescence dosimeters: Methods of evaluation and detection limits.** Czarnecki, J.; Baggenstos, M.; Schuler, J.; Voelkle, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

A method of calculation has been developed and tested which permits data quality control and the determination of net radiation doses resulting from gaseous emissions. Meteorological influences and errors resulting from the method of evaluation are eliminated by a statistical method. The net doses result from the difference between the measured values and the so-called dose expectation values calculated on the basis of measurements made before start-up of the plant. The maximum possible accuracy and the possible detection limit are established for the net doses on the basis of a detailed error analysis. The method is illustrated by the example of TLD measurements in the vicinity of Muehleberg, Leibstadt and Goesgen-Daeniken nuclear power plants.

5343 (FS—83-30-T, pp 353-356) **NADAM, a national network of automatic measuring stations for remote local dose measurement and centralized evaluation in Switzerland.** Ribordy, L.; Michaud, B.; Huber, O.; Wicht, F.; Honegger, P. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The NADAM-network, having started in Summer 82 with 8 pilot stations, will at the end consist of 51 automatic measuring stations, distributed at the locations of the national meteorological network ANETZ all over Switzerland. The values of each local dose-rate, measured with a GM-tube sensor, are transmitted every 10 minutes through telephone lines to a central station. There, the computer linearizes the data (5 μR/h to 5 R/h), warns upon alarm

(threshold 0,1 mR/h) the Emergency Monitoring Center and reduces the values for future treatments (e.g. statistics or correlation with weather data).

5344 (FS—83-30-T, pp 399-402) **Sensitive method to detect uranium and thorium isotopes in environmental samples using anion exchange and alpha spectrometry.** Rosner, G.; Lapointe, M.C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The method is described, explaining preparatory work for various types of samples taken from the environment, the separation of uranium from hydrochloric acid solution and of thorium from nitric acid solution, both using AG 1x4. The contribution further describes the preparation of specimens suitable for α-spectrometry by means of electrolysis, and α-spectrometry in a large-area gridded ionisation chamber. For determination of the counting efficiency, U-232 and Th-234 are used, the latter in a separate β-counting. Examples of the spectra measured are discussed. The detection limits of this method are between 20 and 50 fCi for the various isotopes U-238, U-234, Th-232, Th-230, Th-228, with a counting period of 1200 minutes and a confidence limit of 95%. The chemical efficiency is usually above 80%.

5345 **(JAERI—M-83-084) Atmospheric dispersion model by DPRW (discrete parcel pandom walk) method.** Chino, Masamichi. (Japan Atomic Energy Research Inst., Tokyo). Jun 1983. 39p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703253.

A computer code with DPRW(Discrete Parcel Random Walk) method, is developed for simulating atmospheric dispersion of radioactive cloud from a nuclear power plant in emergency. The validity of model is investigated. In Japan, the nuclear power plants are almost located in coastal zone, and some are on complex terrain. So, in this condition, accurate evaluation is difficult. Then, we have developed three-dimensional particle-diffusion code based on DPRW method. In this model, radioactive cloud is presented by many particles and dispersion mechanism is simulated by random walk of these particles. Calculation by this model is performed for simple wind flow field, in the case of instantaneous and continuous source, and the results are well coincided with the analytic ones. The local tracer experiment at JAERI in 1980 were also used to compare the code against field measurement.

5346 **(JAERI-M—83-071) Report of meteorological observations on the site of Tokai Research Establishment from 1979 to 1981.** Obata, Kazuichi; Kobayashi, Hideo; Katagiri, Hiroshi; Yabuta, Hajimu; Kokubu, Morinobu. (Japan Atomic Energy Research Inst., Tokyo). May 1983. 134p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE84703252.

Results of meteorological observations such as wind speeds, wind directions, solar and net radiations, air temperatures on the site of Tokai Research Establishment from 1979 to 1981 are summarized in the from of meteorological statistics in this report. Hourly data(mean of 10 minutes of each hour) are calculated to obtain daily means of all observation items, monthly frequency distribution of wind speeds, atmospheric stabilities by wind directions and hourly means of wind speed in a month etc.

5347 **(JAERI-M—83-098) Dose evaluation method for the main steam pipe rupture accident by puff and particle-diffusion models.** Chino, Masamichi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1983. 25p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703257.

In case that the main steam pipe rupture accident happens in operating a boiling water reactor, there is a fear that fission products are released in the environment because of outflow of coolant from the ruptured pipe. When the construction of a boiling water reactor is planned, this accident is listed as one of postulated accidents in licensing review of nuclear facilities and safety analysis must be done. The external dose and thyroid dose, caused by the fission products disposed before the close of isolation valves, are evaluated by the simple transport model, called hemisphere model. But, the results computed by this model are overestimated extremely in some conditions. So, we developed more realistic two evaluation codes, based on puff model and particle-diffusion model. These codes can simulate radioactive cloud's buoyancy and dispersion and have a simple external dose evaluation model.

5348 **(JAERI-M—83-113) Computer code which calculates three dimensional mass consistent wind field.** Ishikawa, Hirohiko. (Japan Atomic Energy Research Inst., Tokyo). Jul 1983. 35p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703307.

In order to perform the realistic simulation of the dispersion of radioactive materials released accidentally into the atmosphere, a computer code is developed. This computer code calculates the non divergent three dimensional wind field. The basic concrept is same as that was used in the MATHEW, which was developed at Lawrence Livermore National Laboratory. In our code, the staggered scheme is employed in order to cancel the truncation error and to increase the resolution of the topography. The solution is calculated in double precision. Computational time is reduced. In this report, the result of the tests associated to the convergency of the solution and the effect of the boundary condition are shown together with the description of the model. Some examples of the model application to the real topography are also shown.

5349 **(KFK—3751) Meteorological system and the basic parameters required for predicting the transfer of radionuclides released into the atmosphere.** Shamsaldin, A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Jun 1984. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750019.

The meteorological measuring system, operating at the site of the Karlsruhe Nuclear Research Centre, and the present working programme of the Environmental Meteorology Department of the Karlsruhe Nuclear Research Centre are described in this report. The main aspects of meteorology and radioecology during normal operation and possible accidents arising from nuclear facilities, and natural sources of radioactivity are presented. Besides, different methods of dividing the atmosphere into stability classes and of determining the dispersion parameters are indicated.

5350 **(PB—84-233006) Wind tunnel tests of dispersion from the proposed PWR.** Fackrell, J.E. (Central Electricity Generating Board, Southampton (UK). Technology Planning and Research Div.). 1982. 70p. (TF—212). NTIS, PC E05/MF E05.

This report describes wind tunnel tests performed to model releases from the proposed PWR at Sizewell. The main aim of the work was to compare the experimentally observed building effects on dispersion with those predicted by a virtual source model. A 1:300th scale model of the PWR station and surrounding site, including the Magnox station, was placed in a simulated neutral atmospheric boundary layer. Ten different passive releases were studied, covering routine emissions and accident situations. Eleven different wind directions, were investigated. Plume centreline ground level concentrations, obtained from these patterns, are extensively compared with the virtual source model predictions and complete ground level concentration contour patterns are given for some cases. Some vertical profiles of concentration were also measured. A large number of smoke photographs of the releases were obtained. The effects of a small range of stack heights for releases from the radwaste building are also indicated. The likely performance of the virtual source model in other than neutral stability is discussed.

5351 (ZfI-Mitt—80, pp 89) **Separate measurements of ^{220}Rn and ^{222}Rn in soil air and their scientific interpretation.** Gast, H.; Stolz, W. (Bergakademie Freiberg (German Democratic Republic). Sektion Physik). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5352 (ZfI-Mitt—80, pp 54-55) **Tritium in Antarctica's precipitation - comments on the global distribution.** Hebert, D. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5353 (ZfI-Mitt—80, pp 121) **Variations of hydrogen isotopes in precipitations around Leipzig.** Kowski, P.; Kurze, W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5354 (ZfI-Mitt—80, pp 122) **Variations of hydrogen isotopes in precipitations at Queen Maud Land (Antarctica).** Kurze, W.; Kowski, P.; Trettin, R. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5004 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 5004005356

5006 Regulations

5355 **(PB—84-237833) Cost of clean air and water Report to Congress, 1984. Final report May 1980-August 1983.** (Development Planning and Research Associates, Manhattan, KS (USA)). May 1984. 658p. NTIS, PC A99/MF A01.

See also PB-300446.

The Clean Air Act and Clean Water Act include provisions which require the Administrator of the Environmental Protection Agency to make and report detailed estimates of the costs of carrying out the respective Acts. This report presents such estimates as two separate reports, one concerned with the control of air pollution, the other concerned with the control of water pollution. This summary provides information on both reports and presents listings of the 'Water costs', 'Air costs', and 'combined costs.'.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 5101005434, 5467, 5585, 5617

5356 **(CONF-840181—1) Simulation experiments with late quaternary carbon storage in mid-latitude forest communities.** Solomon, A.M.; Tharp, M.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000979.

From American Geophysical Union Monography meeting on carbon dioxide through geologic time; Tarpon Spring, FL, USA (15 Jan 1984).

The assumption was tested that forest biomass in communities on the modern landscape is equivalent to that in similar communities on the late-Quaternary landscape. Forest carbon storage dynamics during the past 16,000 years were derived from a mathematical model of forest processes and individual tree species behavior. Modern pollen and climate data sets provided pollen-climate transfer functions to generate model driving variables from fossil pollen records. Climate variables were estimated from fossil pollen stratigraphies in Tennessee, Ohio, and Michigan. Only simulated early postglacial warming produced the large carbon gains one would expect in mixed deciduous-coniferous forests from unglaciated regions. The simulated mid-Holocene warming generated little carbon storage response by temperate deciduous forests and large carbon gains in northern hardwood-conifer forests, unlike the linear relationship expected when equivalence is assumed between modern and prehistoric forests. Late-glacial, mid-latitude forests may have contained more biomass than would be expected from equivalent forests on the modern landscape. Simulations of alternate hypotheses to explain the enhanced late-glacial cannot distinguish effects of reduced seasonal temperature extremes from effects of changing species' temperature tolerances. 84 references, 5 figures, 2 tables.

5357 **(DP-MS—84-113) Modeling interception of rainfall by forests and the role of interception in the water balance.** Murphy, C.E. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 37p. (CONF-8410181—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002822.

From Long-term ecological processes in forested waterbeds conference; Athens, GA, USA (15 Oct 1984).

Interception is an important component of the forest water balance that cannot be ignored where accurate water balance estimates are desired. The state of modelling the interception of rainfall has been greatly improved by the development of models using a dynamic canopy water balance. These models show promise of allowing prediction of interception for forests where detailed interception studies have not been done. There is certainly coupling of the forest water balance and the larger scale meteorological processes. However, it does not appear that evaporation of intercepted water takes place in a closed system and advection of dry air is available to keep evaporation rates relatively high under many conditions. This means that interception loss will change significantly with manipulation of forest cover and will affect the water balance. In climates where evaporation of interception is low, it is likely that much of the intercepted water evaporates after the rainfall period. In a post rainfall environment, it is possible for evaporation to be greater than transpiration even if sensible heat is not available as a source of energy. 21 references, 3 figures, 2 tables.

5358 **(LA-UR—84-2569) Solution culture method for studying nutrient uptake and stress.** Kay, L.E.; Gutschick, V.P. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 6p. (CONF-8409127—3). NTIS, PC A02. File Number DE84016748.

From 6. international colloquium on the optimization of plant nutrition; Montpellier, France (2 Sep 1984).

In order to study the uptake of two (or more) different mineral nutrients at very low concentrations, a solution culture system with new capabilities was developed. It allows tight control of nutrient concentrations of very low levels, accurate uptake rate measurements, and frequent non-destructive measurements of plant mass and dimensions. The hydroponic system includes (1) a water-deionizing system, (2) an automated mixing system that can provide up to 3000 liters/day of the base solution containing the non-varied nutrients; (3) seven separate reciprocating syringe pumps, each of which mixes base solution and concentrates of the two varied nutrients and supplies an entire set of plants for one nutritional treatment; (4) growth pots, consisting of 2-liter plastic beakers divided internally into three separate compartments, each provided with a separate nutrient inflow, drain, and aerator/mixer. This once-through (non-recirculating) flow system is constructed entirely of plastics and lesser amounts of other materials in order to minimize chemical contamination. Numerous other advantages are discussed. 3 references, 1 table.

5359 (Zfl-Mitt—80, pp 7) **Quantitative model of the sulfur cycle considering isotope ratios.** Weise, G.; Wetzel, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5360 (Zfl-Mitt—80, pp 8-9) **Processes of substance transformation in the first stages of earth's evolution and the isotope composition of endogenous nitrogen.** Wolynez, W.F. (AN SSSR, Moscow. Inst. Litosfery). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5361 (Zfl-Mitt—80, pp 43) **delta^{15}N soil profiles and their temporal changes.** Huebner, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5102004363, 5314, 5315, 5443, 5460

5362 (EPRI-EL—3581, pp 1.1-1.6) **PCB update.** Manger, H.C. (Baltimore Gas and Electric Co., MD). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The use of polychlorinated biphenyl (PCB) in electrical equipment is reviewed. PCB is chemically stable, not soluble in water, and not volatile. In the early 1940's, electrical equipment manufacturers, because of its nonflammable property, started to use PCB in applications where personnel and property protection were important. The regulations governing the transportation and use of PCB in electrical equipment are discussed.

5363 (EPRI-EL—3581, pp 1.7-1.11) **EPRI update: emphasis on PCDF.** Addis, G.; Komai, R. (Electric Power Research Inst., Palo Alto, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

EPRI's involvement in polychlorinated biphenyl (PCB) problems is discussed. It is hoped that this work will provide the bases for future analytical gains and the development of data that will provide decision guidance in the retrofill or replacement of PCB equipment. The work at EPRI is described under the following topics: analytical instrumentation, destruction of askarel fluids and capicitors, retrofilling and replacement options, decontamination of mineral oil, spill clean-up, risk assessment, and polychlorinated dibenzofuran (PCDF)/polychlorinated dibenzodioxin (PCDD).

5364 (EPRI-EL—3581, pp 2.1-2.4) **Field determination of PCB in transformer oil: CLOR-N-OIL kit.** Fisher, D.J.; Rouse, T.O.; Lynn, T.R. (General Electric Co., Pittsfield, MA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Ultimately, 35 million oil-filled transformers now in service in utility and industrial applications may have to be tested for PCB content to assure proper disposal. While adequate analytical methods exist for the determination of PCB content in oils in the laboratory, this process is time-consuming. The objective of the work reported was to reduce this problem by developing techniques for the measurement of PCB in transformer mineral oils by non-chemists in the field. Recent attention to this problem has focused on the development of a small disposable means of screening PCB by determining the chlorine content of the transformer oil. This led to the development of the CHLOR-N-OIL PCB screening kit. The testing and performance of the kit are discussed.

5365 (EPRI-EL—3581, pp 2.5-2.6) **CLOR-N-OIL field test program.** Tahiliani, V.H. (Electric Power Research Inst., Palo Alto, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

A test kit for determining the chlorine content of transformer insulating oils is described. The kit called CLOR-N-OIL is used to determine the presence of PCB in transformer oils. The field test program for the kit is discussed. A total of 879 oil samples were tested with the CLOR-N-OIL kit as well as on a gas chromatograph. Of the 879 samples, 424 tested negative indicating less than 50 ppb of PCB. The remaining 455 samples tested positive. It was found that through the use of the CLOR-N-OIL screening test, half of the oil samples can be eliminated from any further testing. The test method can offer a significant cost savings to the utility industry.

5366 (EPRI-EL—3581, pp 2.7-2.10) **Interpretation of PCB field testing kits.** Walsh, E.J. (Westinghouse Electric Corp., Sharon, PA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The basis upon which the PCB-in-oil field test kits now appearing on the market operate is discussed. There are two major categories of test types: the instrumental type or a chemical-based detection method. All of the kits operate on the same assumption that a means of detecting total chlorine content can be useful in determining the presence of PCB's in oil. The proper use and interpretation of these kits can result in reducing gas chromatographic testing by 50 to 60%. These kits also provide a rapid and portable means of evaluating potential problems for oil spills in the field.

5367 (EPRI-EL—3581, pp 2.11-2.18) **Detection of PCBs by infrared spectroscopy.** Nordstrom, R.J. (Battelle Columbus Laboratories, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The possibility of using infrared spectroscopy for the detection of PCB's is supported by the fact that the commonly used askarels in transformers have very strong infrared absorsption bands. The construction of a field-usable instrument for the detection of PCB's in transformer oil based on infrared absorption is proposed. The operational parameters for the instrument are given. The instrument performs analytical chemistry functions in the field which usually require a trained analyst and complex instrumentation.

5368 (EPRI-EL—3581, pp 2.19-2.34) **Field determination of Aroclors using an automated electron capture detector gas chromatograph.** Picker, J.E.; Colby, B.N. (S-CUBED, La Jolla, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Owing to existing government regulations concerning PCB-containing materials, a search for a reliable and portable instrument to identify and measure Aroclors was undertaken. The four major considerations for the instrument were: it must be portable, it must require only limited operator experience or training, expected regulatory procedures for the determination of Aroclors should be invalued, and the range over which the instrument can monitor PCB concentrations should be as wide as possible. It was decided to develop a field transportable gas chromatograph with an electron capture detector called the PCBA-102 to meet these needs. The design, performance testing, and uses of the instrument are described.

5369 (EPRI-EL—3581, pp 2.35-2.47) **Semiquantitative detection of polychlorinated biphenyls (PCBs) in contaminated soils by thin-layer chromatography.** Piechalak, B. (Commonwealth Edison Co., Maywood, IL). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

As a consequence of their persistence, their ability to accumulate, and their distribution throughout the environment, PCBs have become a well-known environmental pollutant. PCB-filled capacitors are potential sources for PCB release to the environment. If a pole-top capacitor ruptures, PCB released to the area beneath the pole must be collected and the contaminated ground removed. The main objectives of this study were to investigate the detection of PCBs in contaminated soils using thin-layer chromatography and to evaluate its use as an aid during clean-up operations. The method was found to be sensitive at the 50 ppm level and yielded results that are at least a good estimate of the PCB concentration of contaminated soil. As an aid it can be used to expedite the clean-up operations, helping to minimize the amount and length of time contaminated soil is left exposed to the environment.

5370 (EPRI-EL—3581, pp 2.49-2.73) **Portable infrared field monitor for PCBs: phase II.** Denton, M.S.; Walker, M.H. (C/S Associates, Inc., Oak Ridge, TN). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—). Contract W-7405-ENG-26.

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Since the Dallas, Texas EPRI Seminar of December, 1981, a great deal of effort has been expended on developing and commercializing PCB destruction and cleanup from askarels and transformer oils. PCB-contaminated oil is still being stockpiled at an alarming rate and PCB spills continue to occur. These problems have proven to be extremely challenging ones with no widely accepted, definitive and economically feasible answers. Unfortunately, regulations have become more stringent and are more widely affecting personnel throughout the electric power industry. It is hoped that this Phase II study on refining and field proving an infrared (IR) portable monitor, preliminarily developed in Phase I for PCBs in spill conditions, will be of assistance in each of the aforementioned problem areas. The largest PCB problems occur in the form of PCB-contaminated oil in field transformers and storage containers, and pure askarel in transformers and capacitors. The most immediate need for a portable field instrument is still for use under PCB spill conditions. A simple, rugged, reproducible, and PCB-specific infrared analyzer and sampling protocol has been developed and field tested to fill this void. The design and performance of the instrument are discussed.

5371 (EPRI-EL—3581, pp 3.1-3.7) **Utility PCB dilemma: retrofill or replacement?.** Forrester, T.L.; Milby, T.H. (Pacific Gas and Electric Co., San Francisco, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The electric utility industry faces two dilemmas: (1) the selection of a suitable PCB substitute fluid, and (2) what to do with the PCBs on hand. Three options are available to the electric industry to resolve the PCB problem: (1) a retrofill program whereby the concentration of PCBs is reduced in existing equipment, (2) a total replacement program whereby all PCB equipment is replaced, and (3) some combination of a retrofill and replacement program. Insights into the type of considerations which are important and should be evaluated before a final discussion on PCB retrofill or replacement is made are presented.

5372 (EPRI-EL—3581, pp 3.9-3.22) **Cleaning askarel transformers using silicone retrofill and adsorption techniques to remove residual PCBs.** Meyer, D.F.; Reynaert, E.A. (Dow Corning Corp., Midland, MI). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Under present EPA rules, owners of PCB-filled transformers that pose an exposure risk in food or feed plants cannot continue to use these units after Oct. 1, 1985. Other owners of these transformers are seeking alternatives to the outright replacement of these units, particularly where the removal of the old transformer is costly in terms of service interruption or because it is inaccessable without major changes in the structure in which it is housed. One alternative is to clean the PCB transformer by using silicone liquid retrofill and adsorption technique to remove residual PCBs. The feasibility of this alternative is discussed.

5373 (EPRI-EL—3581, pp 3.23-3.26) **C_2Cl_4 as a substitute for PCBs.** Walsh, E.J. (Westinghouse Electric Corp., Sharon, PA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The development of a C_2Cl_4 tetrachloroethylene based insulation system for transformers as a substitute for PCBs is discussed. There were four primary criteria used in evaluating candidate fluids for use in transformers. These were functionality, flammability, economics, and toxicity. A fluid must be capable of meeting all four requirements to be a candidate. It was found that C_2Cl_4 is an acceptable substitute for PCBs.

5374 (EPRI-EL—3581, pp 4.1-4.13) **Clean-up of soils contaminated with PCBs.** Kitchens, J.F.; Mangoba, L.B.; Anspach, G.L.; Kobylinski, E.A. (Atlantic Research Corp., Alexandria, VA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Large tracts of land across the country are contaminated with PCBs. Because of the low solubility of PCBs in water, the migration of PCBs through soils is not as rapid as observed for some other chemicals. However, as the PCBs approach property boundaries and water supplies, decontamination of the soil becomes necessary. The usual disposal method consists of physical removal of the contaminated soil to an approved landfill. Under ideal circumstances, impermeable clay barriers have also been used to stop the migration of soil contaminants. Both methods are expensive and do not remove the PCB contamination from the environment. Experiments have been performed that demonstrate the feasibility of extracting the PCBs from soil. By choosing a solvent that does not pose an environmental hazard, the soil can be returned to its original site without incurring the costs of long distance transportation required for landfilling. Once the PCBs are in the solvent, the LARC process can be used to dehalogenate the PCBs and the solvent recycled. The on-site extraction and destruction of PCBs appears very attractive when compared to alternative disposal/containment processes.

5375 (EPRI-EL—3581, pp 4.15-4.24) **Cleaning of PCB contaminated soils.** Weitzman, L. (Acurex Corp., Cincinnati, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The cleanup of PCB spills is a major concern to the utility industry. These occur if a capacitor, transformer, switch or other PCB-containing equipment develops a leak while in service and contaminates the surrounding area. The current method of cleaning up a small site such as a leaking transformer, involves removing the soil and taking it to a chemical waste landfill that has been approved for PCB burial. Soil washing is examined as an alternate PCB cleanup procedure. The technique has the potential to remove PCBs from soils onsite, and therefore, eliminate both hauling, landfilling and backfilling for cleanup, thereby reducing the cost substantially. Two soil-washing techniques were examined. The first, solvent washing, was found to be applicable to most situations even where the final PCB concentration in the soil must approach zero. The second technique, water washing, proved to be impractical. The performance of the solvent washing method is described.

5376 (EPRI-EL—3581, pp 4.25-4.57) **Cost of PCB spill cleanup: a question of degree.** Woodyard, J.P.; Trench, W.C.; McCormick, P.; Juhasz, T. (IT Corp., Wilmington, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The degree of PCB spill cleanup required by regulatory agencies, or how clean is clean, has evolved into one of the most prominent issues surrounding PCBs today. Despite the continued occurrence of PCB spills throughout the US, spill cleanup degree is not explicitly addressed under TSCA. The degree of cleanup required to avoid a disposal citation varies with EPA region and state, to the inconvenience and cost of industry. The current state of regulation for PCB spill cleanup is reviewed, and the compatibility of these regulations with current practice is assessed. Several generic spill situations are presented for use in quantifying the cost of alternate cleanup procedures. Based on these situations, a cost/engineering model is presented. Results of the model are shown, including graphics to illustrate cost sensitivity to cleanup degree and spill type. Conclusions are drawn regarding degree-of-cleanup policy, its economic impact and the future regulatory climate.

5377 (EPRI-EL—3581, pp 4.119-4.133) **Composting for degradation of PCBs in soil.** Isbister, J.D.; Anspach, G.L.; Kitchens, J.F. (Atlantic Research Corp., Alexandria, VA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

This study evaluated aerobic and anaerobic composting of PCB contaminated soil on a laboratory scale. Composts were composed of alfalfa hay, horsefeed and Lakeland soil spiked to contain 2000 mg/Kg of Aroclor 1242 (dry weight basis). Warm humidified air was drawn through aerobic compost materials. Anaerobic composts were flushed with nitrogen. All composts were incubated at 55°C. After two and four weeks of incubation, compost materials were oven dried, round, subsampled and Soxhlet extracted for GC analysis. The aerobic composts showed the greatest destruction of PCBs with 41.6 and 48.1% destruction in two weeks and 55.7 to 67.6% destruction in four weeks. PCB destruction in anaerobic composts was 18.4 to 28.0% after two weeks and 27.9 to 46.9% after four weeks of composting. Individual peak areas from the GC chromatograms of control and test compost extracts were compared to determine the decrease of different PCB isomers. A significant decrease in the trichlorobiphenyls and one of the tetrachlorobiphenyls was observed in extracts from the two week aerobic composts. After four weeks of aerobic composting, significant decreases in all of the chlorinated biphenyls were observed. Anaerobic composting showed significant reduction of all chlorinated biphenyls after four weeks of composting. The mechanism of degradation appears to be rapid dechlorination of biphenyls containing three chlorines or less since no build-up of the mono- or dichlorinated compounds was observed. Dechlorination of the penta- and tetra-chlorinated molecules is slower but does occur at a useful rate. No chlorinated dibenzo-p-dioxins or dibenzofurans were found in the chromatograms or in the GC-mass spectra run on the composted sample extracts.

5378 (EPRI-EL—3581, pp 4.135-4.146) **Bacterial degradation of polychlorinated biphenyls in sludge from an industrial sewer lagoon.** Kim, W.S.; Takacs, A.M.; Kuivinen, D.E. (Lewis Research Center, Cleveland, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

A laboratory experiment was conducted to determine if polychlorinated biphenyls (PCB's) found in an industrial sewer sludge can be effectively degraded by mutant bacteria. The aerated sludge was inoculated daily with mutant bacteria in order to augment the existing bacteria with bacteria that were considered to be capable of degrading PCB's. The pH, nitrogen, and phosphorus levels were monitored daily to maintain an optimum growing medium for the bacteria. A gas chromatographic method was used to determine the PCB concentrations of the sludge initially and also throughout the experiment. Results and discussion of the bacterial treatment of polychlorinated biphenyls are presented.

5379 (EPRI-EL—3581, pp 5.1-5.28) **Destruction of high concentration PCBs in a utility boiler.** Siedhoff, T.E.; Zale, C.A.; Morris, H.E. (Union Electric Co., St. Louis, MO). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Most electric utilities produce significant quantities of waste oil and other combustible products during the course of normal business activity. The greatest majority of these wastes come from two primary sources: (1) dielectric fluids used in electrical equipment, and (2) lubricating oils used in motor vehicles and large power plant machinery. Because of previous manufacturing and servicing procedures, some mineral oil dielectric fluids will inadvertently contain the chemical compound polychlorinated biphenyl or PCB in varying but generally low concentrations. Other dielectric fluids, known generically as askarel, intentionally contain about 60% PCBs for a specific purpose and use. In comparison to many other organic chemicals the scientific information available would seem to indicate that PCBs are relatively low in toxicity. However, because of their extreme stability and bioaccumulative nature and the inexact nature of the science in this area, prudent action requires that special care be taken to see that these fluids are disposed of properly. An engineering analysis of the design features and operational parameters of a PCB incinerator are presented which lead to the conclusion that the boiler can essentially destroy all PCBs introduced and the results of a carefully planned test burn which was conducted confirm these conclusions.

5380 (EPRI-EL—3581, pp 5.29-5.31) **Arc pyrolysis of PCBs.** Wittle, J.K.; Titus, C.H.; Blois, S.O. (Electro-Petroleum, Inc., Wayne, PA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

A three-year program to design, construct, demonstrate and commercialize a high temperature DC arc furnace for the destruction of PCBs and PCB contaminated wastes is discussed. The technology is based upon the utilization of a direct current arc impinging upon a molten metal bath. The system is designed so that initial decomposition takes place in the molten bath and the resultant gaseous products are passed in the vicinity of the high temperature arc. The system reduces the PCBs to HCL, CO, H_2, and carbon by thermal pyrolysis. When solids are added to the system, they will melt and slag in the molten pool. The arc furnace system is made up of three major subsystems. They are, the electrical system (power supply), arc furnace, and gas handling equipment. Major effort is underway to site the prototype system, provide for adequate environmental protection and develop analytical procedures for evaluating the process, as well as obtaining appropriate permits. The objective of this project is to develop a mobile alternative technology to conventional incineration which can destroy PCB solids with an efficiency acceptable to regulatory agencies, at an acceptable cost for construction, operation and maintenance, and with environmentally acceptable solid waste and waste streams.

5381 (EPRI-EL—3581, pp 5.33-5.47) **Chemical cleaning of PCB capacitors.** Weitzman, L. (Acurex Corp., Cincinnati, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The disposal of capacitors containing polychlorinated biphenyl (PCB) dielectric fluids is a major problem for the electric utility industry. Before March 1, 1981, the Environmental Protection Agency (EPA) had allowed their disposal in chemical waste landfills; however, with the start of operation of the Energy Systems Corporation (ENSCo) incinerator in El Dorado, Arkansas, EPA ruled that sufficient capacity was available and landfilling would no longer be permitted. This prompted an effort by the EPRI to identify other technologies with which to destroy them. A series of studies which evaluated the chemical destruction of PCBs in capacitors is described and a system to do this was designed.

5382 (EPRI-EL—3581, pp 5.49-5.61) **Mobile plasma pyrolysis.** Barton, T.G.; Mordy, J.A.G. (Royal Military Coll. of Canada, Kingston, Ontario). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

A thermal plasma, properly applied to toxic waste destruction, provides a pyrolytic environment with distinct advantages over other competing technologies. Complete atomization of organic fluids has been demonstrated to occur in less than one third of a millisecond. Kinetic recombinations of atomic entities are predictable. Chlorinated wastes produce a hydrogen chloride byproduct which is completely converted to salt in a caustic scrubber. Destruction efficiencies in excess of 99.9999999% have been corroborated by external monitoring agencies for the destruction of Askarel fluids with chlorine contents up to 58%. Since this process is pyrolytic, the scale of the equipment is small for high throughput rates. Energy requirements for the destruction of Askarels are typically less than one kilowatt-hour per kilogram of waste. A mobile prototype unit is being constructed for the Department of Environmental Conservation of the State of New York for a throughput rate of one gallon per minute of liquid waste. The mobility and efficiency of such systems limit the controversy associated with siting fixed facilities.

5383 (EPRI-EL—3581, pp 5.63-5.73) **Energy and by-product recovery from chlorinated hydrocarbons: Chloe-Chimie's VRC incineration process for polychlorinated biphenyls.** Gallay, J. (Pyrochlor, Inc., Chatham, NJ). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Chloe-Chimie, a subsidiary of the French Groupe Elf Aquitaine, has developed and successfully marketed a heat and byproduct recovery process using waste chlorinated hydrocarbon residues. The prototype, full-scale incineration unit, termed the VRC process, has been in operation in Saint-Auban, France since 1974 and has a capacity of 16,000 tons of waste materials per year. It can accept 2000 kgs/hr of chlorinated waste, is designed to operate at 1200°C at a retention time of 5 seconds, and can produce 4300 kgs/hr of clear 33% HCl. Tests with waste PCBs were conducted in October 1979 and May 1981 and showed no discernable PCBs, PCDFs, and PCDDs in effluents at detection limits of 0.1 ppb (100 ppt) for each entity. Borden Chemical is currently operating a larger Chloe-Chimie VRC unit at its Geismar, Louisiana chlorinated solvents plant.

5384 (EPRI-EL—3581, pp 6.1-6.20) **PCBs, PCDFs, and PCDDs resulting from transformer/capacitor fires: an overview.** desRosiers, P.E. (Environmental Protection Agency, Washington, DC). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

An overview of what is considered to be current information concerning PCB transformer/capacitor fires in the US is given. On December 15, 1983, the Environmental Protection Agency issued a national dioxin strategy for investigating, identifying, and cleaning up sites contaminated by dioxin. Within the framework of this strategy is a plan that calls for research to be conducted on PCB transformer/capacitor fires. This research will entail an investigation into the characterization of sources of PCDFs and PCDDs, that is, the chemistry of PCB fires and theoretical products of thermal stress based on composition of askarel used; emergency response protocols for firemen, including protective clothing, and practical remedial measures for building cleanup. It is felt that only through the sharing of information and full cooperation among electrical utilities, chemical manufacturers, firemen, insurers, EPRI, EPA, and NIOSH can preventive maintenance be performed to minimize or preclude future impacts of PCB transformer/capacitor fires.

5385 (EPRI-EL—3581, pp 6.59-6.67) **Update on analytical methods for polychlorinated biphenyls (PCB), polychlorinated dibenzofurans (PCDF), and polychlorinated dibenzo-p-dioxins (PCDD).** Cooke, M.; DeRoos, F.L.; Gebhart, J.E.; Slivon, L.E.; Mondron, P.J. (Battelle Columbus Laboratories, OH). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Evidence supporting the widespread distribution of polychlorinated biphenyls (PCB) in the environment has been documented as early as 1966, when PCB were found to interfere with the environmental determination of pesticide residues. Due to the persistence and widespread geographic distribution of PCB, animal and human toxicological studies were performed which subsequently led to the regulation of these compounds by the Toxic Substances Control Act in 1976. Until regulation was enacted, commercial mixtures of PCB, named Aroclors, were widely used in the electric power industry as dielectric fluids in capacitors and transformers. During fires involving transformers, incomplete combustion of Aroclor containing oil produced chlorinated furan and dioxin compounds. The large number of isomeric forms and the complex nature of environmental matrices pose a difficult problem to determine the existence, distribution, and toxicity of PCBs in the environment. Glass capillary gas chromatography, combined with high resolution gas chromatography/high resolution mass spectrometry, and other sophisticated analytical methods offers a means for solving this problem.

5386 (EPRI-EL—3581, pp 6.69-6.78) **Detection of polychlorinated dibenzofurans and other chlorinated pyrolysis products in the soot formed in PCB fires.** Williams, C.H. Jr.; Prescott, C.L.; Garretson, L.D. (Radian Corp., Austin, TX). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Uncontrolled electrical fires involving transformer oils containing PCBs are found to form a complex and potentially toxic mixture of chlorinated products in the soot, including the chlorinated dibenzofurans (CDFs), with degrees of chlorination from Cl_1 to Cl_8. Concentration levels vary widely, depending on the specific conditions of the fire, but levels of 2,3,7,8-tetrachloro dibenzofuran (2,3,7,8-TCDF) in the range of 1-10 $\mu g/g$ of soot were measured in some samples. In the same samples, no chlorinated dibenzodioxins (CDDs) were detected, but several other classes of chlorinated products were found in greater abundance than the CDFs. These included the chlorinated biphenylenes (Cl_1-Cl_8) and chlorinated PNAs, such as the chlorinated pyrenes (Cl_1-Cl_8), as well as residual PCBs. Unchlorinated PNAs from anthracene to the benzopyrene (5 ring) group were also detected at levels comparable to the PCBs.

5387 (EPRI-EL—3581, pp 7.1-7.5) **Solvent extraction of PCB from transformer mineral oil.** Addis, G.; Rouse, T.; Walker, C.; Way, P. (Electric Power Research Inst., Palo Alto, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Polychlorinated biphenyls (PCBs) can be removed from a transformer mineral oil by mixing the oil with an immiscible liquid in which PCB is soluble. PCB will be removed from the oil into the extraction liquid until equilibrium is reaced. The extraction of PCB by the monomethyl ether of diethylene glycol is discussed. The results of preliminary tests indicate that reflux extraction of PCB from transformer oils can be done with high efficiency. Preliminary estimates suggest that it is potentially cost competitive with other processes.

5388 (EPRI-EL—3581, pp 7.7-7.18) **Pilot plant studies for solvent extraction of polychlorinated biphenyl (PCB).** Hancher, C.W.; Saunders, M.B. (Oak Ridge Y-12 Plant, TN). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—). Contract W-7405-ENG-26.

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

The pilot-plant extraction system processed oil with a PCB concentration as high as 300 ppm at a rate of 0.8 L/min using two columns which were each 10 cm in diameter and 4.6 m high. Higher volume flows and lower PCB removal should be obtainable if larger extraction columns were used. The PCB removed from the DMF is 16 to 20 times more concentrated than the PCB present in the original oil. The recovery of dry DMF (less than 1.5 vol % water) was accomplished using distillation at a rate of 0.38 kg/h-cm^2 (based on distillation column cross section). The polychlorinated biphenyl (PCB) concentration system performed very satisfactorily while using dimethylformamide (DMF) as a solvent.

5389 **(LRAP—32) Lidar measurements on sulphur dioxide plumes.** Egebaeck, A.L.; Fredriksson, K.; Hertz, H. (Tekniska Hoegskolan, Lund (Sweden). Fysiska Institutionen). Oct 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750231.

Two field tests for the application of the lidar technique in measurements on sulphur dioxide plumes were performed. Studies on plumes from an oil-burning heating plant and a similar coal- and oil-burning plant in different topographic environments are given, predominantly in the form of vertical and horisontal projections of the plume.

5390 **(ORNL-NSF-EP—1) Mercury in the environment: the human element.** Wallace, R.A.; Fulkerson, W.; Shults, W.D.; Lyon, W.S. (Oak Ridge National Lab., TN (USA)). 1971. Contract W-7405-ENG-26. 61p. NTIS.

This review is directed toward an understanding of the uses, sources, distribution, and toxic effects of mercury, and the main emphasis is on man as the distributor and recipient of mercury in the environment. The societal flow of mercury is initially considered. The main conclusion is that there is a need to pay more attention to the social implications of present use practices and to recycle much more effectively or develop alternatives to present mercury technology. The most important man-made sources of environmental mercury in the US are chlor-alkali plants, seed dressing agents, and probably smelting operations and the burning of fossil fuels. It has been found that whatever the source and compound of mercury introduced into an aquatic system, essentially only the highly toxic methylmercury form is found in the flesh of fish. The formation of methylmercury appears to be promoted by bacterial processes occurring within contaminated bottom sediments, and such sediments can slowly release their mercury burden as methylmercury for many years to come. Details are provided regarding the toxicity of mercury and its compounds. Appendices are included which consider aspects of the physical and chemical properties of mercury, evaluate analytical procedures used for mercury determination, discuss the chlor-alkali manufacturing process and procedures for reducing mercury losses, and provide some present and future needs with respect to our understanding and dealing with mercury in the environment.

5391 **(PB—84-232560) Use of short-term bioassays to evaluate environmental impact of land treatment of hazardous industrial waste. Final report 1 September 1980-30 November 1983.** Brown, K.W.; Donnelly, K.C.; Thomas, J.C. (Texas Agricultural Experiment Station, College Station (USA)). Aug 1984. 386p. NTIS, PC A17/MF A01.

A four phase study was conducted to evaluate utility of short-term bioassays in monitoring environmental impact of land treatment of hazardous waste. During phase one, three microbial bioassays were conducted to define chronic toxic potential of each waste selected for study. Acid, base, and neutral fractions of each of three wastes studied induced genetic damage in at least two of the three bioassays. Phase two was conducted to evaluate efficiencies of blender and soxhlet extraction procedures, as well as potential interactions between known mutagens and soil components. Results indicate that there was no appreciable difference in mutagenicity of the extract using either procedure. Using the blender procedure extraction efficiency for pure compounds added to soil averaged greater than 85%, as measured by High Pressure Liquid Chromatography. Phase three consisted of a greenhouse study in which each of three wastes was applied to two soils. Results from chemical analyses indicate that waste constituents were degraded in soil during a 360 or 340 day interval. Increased mutagenic activity was exhibited in some soil and water extracts during this same interval. When compared on an equivalent volume basis, however, mutagenic potential of waste-amended soils was reduced over time and, in some cases, was reduced to a non-mutagenic level. Wood-preserving bottom sediment was applied to barrel-sized lysimeters in the final project phase to compare results of soil-core and soil-pore liquid monitoring. Different types of compounds were detected in soil-core and soil pore liquid samples.

5392 **(PB—84-242569) Control technology assessment of hazardous waste disposal operations in chemicals manufacturing: walk-through survey report of E. I. Du Pont de Nemours and Company, Chambers Works, Deepwater, New Jersey.** Anastas, M. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Jan 1984. 16p. (CT—103-15A). NTIS, PC A02/MF A01.

See also PB84-242577.

A walk through survey was conducted to assess control technology for hazardous wastes disposal operations at du Pont de Nemours and Company (SIC-2800), Deepwater, New Jersey in November 1981. Hazardous wastes generated at the facility were disposed of by incineration, wastewater and thermal treatment, and landfilling. Engineering controls for the incineration process and at the landfill were noted. At the landfill, water from a tank trailer was sprayed periodically to suppress dust generation. Vapor control devices, such as spot scrubbers, were used during transfer of organic wastes from trailers and drums to storage prior to incineration. Wastes were also recirculated to prevent build up of grit in the strainers. The company conducted area monitoring for nitrobenzene (98953) and amines at the landfill and personal monitoring for chloramines at the incinerator. Half mask dust respirators were worn by landfill operators. Operators who unloaded and emptied drums at the incinerator were required to wear face masks, rubber gloves, and boots. The author concludes that disposal of hazardous wastes at the facility is state of the art. An in depth survey is recommended.

5393 **(Y/DZ—119) Removal of PCB from oils and soils.** Hancher, C.W.; Napier, J.M.; Kosinski, F.E. (Oak Ridge Y-12 Plant, TN (USA)). 1 Nov 1984. Contract AC05-84OS21400. 8p. (CONF-841187—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002619.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

Processes have been developed for the removal of polychlorinated biphenyl (PCB) from waste oils and PCB from contaminated soils. The process for removal of PCB from oils involves using dimethyl formamide (DMF), as the extractant, and water to remove PCB from the extractant. After the addition of water to the DMF extractant, the concentrated PCB is phase separated and requires further treatment such as incineration. The water is removed from the DMF by distillation and recycled, while the water-free DMF is recycled to the extraction column. The PCB-free oil can be reused. Pilot plant data on the process will be discussed. A solvent composed of water and kerosene is used to extract PCB from soil. The water-kerosene leaving the extraction system is phase separated and both components are reused. The kerosene containing the concentrated PCB is steam distilled to further concentrate the PCB. The distilled kerosene is reused. The PCB concentrate from the distillation must be directed using other methods, such as incineration. Pilot plant experience on the process will be discussed. 2 tables.

5394 **Proposal for estimation of soil leaching and leaching constants for use in assessment models.** Baes, C.F. III; Sharp, R.D. (Oak Ridge National Lab., TN). *Journal of Environmental Quality;* **12**: No. 1, 17-28(Jan-Mar 1983). Contract W-7405-ENG-26.

A model to predict annual-average, order-of-magnitude leaching constants for solutes in agricultural soils is given. The leaching constants, specific by geographic locations and solute, are for use in exposure, dose, or risk assessment models to account for removal from the root zone via leaching in a manner analogous to radiological decay. The model presented here relates annual-average water infiltration (V/sub w/) with soil bulk density (rho) and porosity (theta) and the distribution coefficient (K/sub d/) for the solute. Annual infiltration is determined from site-specific estimates

of total precipitation (P), irrigation (I), and evapotranspiration (E). A review, discussion, and determination of generic default model input parameters is included. The parameters rho and theta vary within a factor of three, and are lognormally distributed with estimated geometric mean values of 1.35 g cm^{-3} and 0.48 cm^3 cm^{-3}, respectively. Geographic distributions of US county-averaged P, I, and E were determined from historical weather station records, the 1974 Agricultural Census, and an evapotranspiration model, respectively. The most variable and unpredictable parameter is K/sub d/, which may range from one to many orders of magnitude, depending on solute and soil characteristics, including pH. Estimated distributions of K/sub d/, for 27 elements in soils $4.5 \leqq pH \leqq 9.0$, and correlations between K/sub d/ and pH for Cu, Zn, Cd, and Pb are also included. Finally, eight comparisons of model predictions with leaching constants, determined directly from observed data, are made for Pu, Sr, and Tc. In all comparisons, except one study of Pu, the model predicted leaching constants within an order of magnitude of observed values. For Pu the model underpredicted, and for Sr and Tc the model overpredicted leaching rates.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5103004363, 4388, 4393, 4396, 4757, 5231, 5235, 5286, 5287, 5339, 5340, 5344, 5351, 5407, 5561

5395 **(IAEA-R—2415-F) Assessment of the radiological impact of selected building materials. Final report for the period 1 August 1979 - 31 August 1982.** Gwiazdowski, B. (International Atomic Energy Agency, Vienna (Austria)). Feb 1983. 116p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703258.

Naturally occurring radionuclides in building materials are a source of external and internal radiation exposure to essentially the entire Polish population. The programme of our studies met two main aspects on radioactivity of building materials: Gamma dose rate and radon or alpha potential energy concentration measurements in dwellings of various kinds of structure and materials in both industrial and rural districts of Poland. Gamma dose rate measurements were made in about 2200 dwellings and radon or alpha potential energy concentration measurements - in 750 dwellings. On the basis of these studies the annual effective dose equivalent to the Polish population due to gamma and alpha radiation indoors was estimated to be 0.39 mSv/a and 0.99 mSv/a, respectively. The contribution of external (from gamma) and internal (from alpha) radiation exposure due to naturally occurring radionuclides in building materials to the total radiation exposure of Polish population was assessed to be 3.6 per cent and 34.2 per cent, respectively. Measurements of about 1500 samples of various kinds of building materials and raw materials were made to determine radionuclide concentrations in them. The highest values were obtained in samples of phosphogypsum, fly ash and slag: potassium concentration ranges up to 36 pCi g^{-1} (a slag sample), radium - up to 17 pCi g^{-1} (a phosphogypsum sample) and thorium - up to 4 pCi g^{-1} (a phosphogypsum). On the basis of the results of our studies we came to the conclusion that it was necessary to work out a control system which could protect habitants against enhancement of indoor exposure to ionizing radiation.

5396 **(IAEA-RL—111) Report on intercomparison IAEA/SOIL-6 of the determination of Cs-137, Pu-239, Ra-226, and Sr-90 in soil.** Pszonicki, L.; Hanna, A.N.; Suschny, O. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Apr 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703250.

The report presents results of a laboratory intercomparison of the determination of the activity level of cesium-137, plutonium-239, radium-226 and strontium-90 in a provided soil sample organized by the IAEA's Analytical Quality Control Service. Twenty-seven laboratories from 16 countries returned results based on 77 laboratory means (295 individual determinations). The aim of the interlaboratory comparison was to offer to the laboratories engaged in soil investigation an opportunity to control their analytical performance and to establish the concentration level of some radionuclides in a batch of analyzed soil for certification purposes. All radionuclides were determined by typical commonly used methods: cesium-137 by direct gamma spectroscopy, plutonium-239 by alpha spectroscopy after separation and electrodeposition, radium-226 by direct determination without or with separation or by determination of radon, and strontium-90 by measurement of its daughter yttrium-90. In general, the results can be accepted as satisfactory at such low level of activity (pCi/kg). The relative confidence intervals of the medians of ^{137}Cs and ^{239}Pu are below +-10% and of ^{226}Ra and ^{90}Sr below +-20%.

5397 **(OEFZS-A—0514) Natural radioactivity of building materials in Austria.** Sorantin, H.; Steger, F. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H.). Mar 1984. 10p. (ST—120/84). OEFZS, A-2444 Seibersdorf, Austria.

Limited Distribution.

About 120 samples of natural and manufactured building materials have been analyzed by gamma-spectrometry for their Thorium 232-, Radium 226- and Potassium 40 - content. Granites showed generally the greatest amounts of the above mentioned radionuclides, whereas other natural products like sand, gravels, marbles and gypsum contained only traces of radionuclides. As regards the manufactured building materials only some types of bricks and chemical gypsum showed relatively high concentrations of radionuclides, while the rest of the bricks, tiles, plaster and accessory materials fulfilled the criteria set up in the OECD-NEA report 1979.

5398 (ZfI-Mitt—80, pp 60-61) **Application of $H_2{}^{18}O$ to ecological and plant physiological problems.** Foerstel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5105 Site Resource And Use Studies

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52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

5399 **(GKSS—83/E/80) Flux corrected transport for one-dimensional simulation models in rivers and estuaries incorporating three-dimensional effects.** Haeuser, J.; Lobmeyr, M.; Eppel, D.; Mueller, A.; Tanzer, F. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1983. 26p. (CONF-830803—10). NTIS (US Sales Only), PC A03/MF A01. File Number DE84752282.

From 3. international conference on numerical methods in laminar and turbulent flow; Seattle, WA, USA (8 Aug 1983).

The paper describes a numerical solution technique for the one-dimensional momentum equation as well as the respective transport processes, including cases of peaked distributions. The technique used is a modified version of Zalesak's flux correction algorithm. Numerical diffusion is substantially reduced and concentrations having high gradients can be simulated for long periods of time without loss of accuracy. The technique can be directly used for two-dimensional problems. The influence of the vertical profiles of velocity and concentration on the horizontal transport is calculated. The velocity profile is assumed to follow the Blasius power law. This assumption is valid for most of the time as is shown by comparisons with field measured data for the Elbe river. The turbulent transport processes are modeled using the Boussinesq ansatz but account for vertical variations. The eddy diffusion coefficient depends upon the Reynolds number, the geometry and the flow conditions. De Chezy's number is the only experimental constant which enters the formulation and is well-known for different bottom types. The bottom shear stress is also calculated analytically and depends on the Reynolds number and the detailed geometry.

The above formulation, however, does not assume time-varying eddy viscosity.

5400 **(PB—84-223098) Columbia River Estuary data development program: tidal marsh plant production in the Columbia River Estuary. Final report.** Macdonald, K.B.; Winfield, T.P. (Woodward-Clyde Consultants, San Diego, CA (USA)). Jun 1984. 186p. NTIS, PC A09/MF A01.

See also PB84-223585. Sponsored in part by Columbia River Estuary Study Taskforce, Astoria, OR and Pacific Northwest River Basins Commission, Vancouver, WA.

This report summarizes the final results of the Emergent Plant Primary Production Work Unit of the Columbia River Estuary Data Development Program (CREDDP). The report describes the species composition, standing crop, and production dynamics of the extensive areas of tidal marsh vegetation that fringe the shores of the Columbia River Estuary and form many of its islands. The role of marsh production is discussed within a conceptual framework of the entire estuarine ecosystem.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 5202004214, 4292, 4310, 4363, 4395, 5314, 5315, 5390, 5415

5401 **(AECL—7800) Reference guide to SOLMNQ - an interactive solution-mineral equilibrium program.** Goodwin, B.W.; Munday, M. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Dec 1983. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84900647.

Computer program FORTRAN.

SOLMNQ is an interactive chemical speciation program that calculates equilibrium distributions for a variety of inorganic aqueous species often found in natural groundwaters. The input to the program is the chemical composition of a hypothetical or real groundwater, including the groundwater pH and oxidation potential (where redox reactions are significant), and the temperature of the analysis. The output from the program is the calculated equilibrium concentrations of aqueous species and complexes, and the degree of saturation of a number of common solids and minerals.

5402 **(DOE/NBM—5003329) Transportation and accumulation of fine-grained sediments in the estuarine environment: recommendations for research.** Schubel, J.R.; Bokuniewicz, H.J.; Gordon, R.B. (State Univ. of New York, Stony Brook (USA). Marine Sciences Research Center). Jul 1978. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003329.

Special report 14.

The primary goal was to identify the important unresolved problems of physical transport processes in estuaries. The secondary goals were: (a) to assess the manpower and material necessary for the field experiments on which the solutions of important unresolved problems must depend; (b) to explore the means for interinstitutional cooperation and collaboration which will be required if the necessary large-scale, extended field experiments anticipated are to be made feasible; and (c) to explore ways in which current monitoring programs which are relatively expensive, can be made more useful both to management and to science.

5403 **(PB—84-232545) Spatial and temporal interpolation of neros radiosonde winds. Final report.** Bullock, O.R. Jr. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Aug 1984. 93p. (EPA/600/3—84-086). NTIS, PC A05/MF A01.

This research program was initiated with the overall objective of determining a most appropriate numerical method for the spatial and temporal analysis of free atmospheric, radiosonde derived, wind observations for the NEROS pollutant transport model. The analysis was to be performed by automated data processing under certain restrictions in computation time and storage area. Previously developed methods of spatial and temporal data analysis were reviewed and their applicability to the NEROS effort were evaluated. Evaluation was based on tests with actual radiosonde data and with data sets produced through numerical model initialization procedures. In all cases, the desired result was a 7 by 6 grid of wind vectors in latitude-longitude space, for every hour during a three day test period. Optimization of applicable spatial analysis schemes was completed and error statistics were calculated based on agreement between analysed grids and observed or computed data at various locations within the NEROS test region. Linear and curvilinear time interpolation methods were tested by applying them to data points before the spatial analysis, and by applying them to grid point values produced by previous spatial analyses.

5404 **(PB—84-246446) EPA (Environmental Protection Agency) method study 23a, method 501.1, trihalomethanes by purge and trap (reannouncement of PB84-169994 - see notes field for explanation).** Warner, B.J.; Cheng, S.C.; Friedman, C.S.; Mitrosky, S.; Snyder, A.D. (Monsanto Research Corp., Dayton, OH (USA)). Mar 1984. 116p. NTIS, PC A06/MF A01.

Re-announcement of PB84-169994 with new abstract.

The experimental design and the results of an interlaboratory study of U.S. Environmental Protection Agency (USEPA) method 501.1 to detect trihalomethanes in drinking water are described herein. In the method, trihalomethanes are extracted by an inert gas which is bubbled through the aqueous sample. The vapors are then trapped on a short column containing a suitable sorbent. The trapped compounds are subsequently thermally desorbed onto the head of a gas chromatographic column. An electrolytic conductivity detector is used to measure the compounds. The six concentrations of spiking solutions contained chloroform, bromodichloromethane, chlorodibromomethane and bromoform. The two waters used in the study were distilled and drinking water, both supplied by the individual laboratories. Statistical analyses and conclusions in this report are based on analytical data obtained by twenty collaborating laboratories. This report was submitted in partial fulfillment of contract 68-03-2856 by Monsanto Research Corporation under the sponsorship of the U.S. Environmental Protection Agency. The report covers a period from September 1979 to December 1982.

5405 **Polycyclic aromatic hydrocarbons in Washington coastal sediments: an evaluation of atmospheric and riverine routes of introduction.** Prahl, F.G.; Crecellus, E.; Carpenter, R. (Univ. of Washington, Seattle). *Environmental Science and Technology;* **18**: No. 9, 687-693(Sep 1984). Contract AC06-76RL01830.

Polycyclic aromatic hydrocarbon (PAH) compositions were characterized monthly over a 1-year period in atmospheric particulate material (APM) collected from three locations in western Washington state and riverine suspended particulate material (SPM) collected near the mouth of the Columbia River. PAH mixtures of APM are dominated by compounds of combustion origin, with minor levels of the resin acid-derived PAH retene often present. SPM contained comparable levels of individual combustion PAH, retene, and perylene. Atmospheric and riverine contributions of individual combustion PAH to the Washington coastal environment were estimated from these data and other available information. Comparison of estimates with respective PAH accumulation rates measured in lead-210 dated coastal sediments shows that >30% of all combustion PAH, retene, and perylene in these sediments is supplied by SPM discharge from the Columbia River and direct atmospheric input accounts for at most 10% of the combustion PAH. Atmospherically transportable PAH are removed from the air over land to soils and freshwaters within the river drainage basin, eroded on particles, and discharged into the Washington coastal environment along with other nonatmospherically transportable PAH such as perylene as intrinsic constituents of the Columbia River's suspended sediment load.

5406 **Microbial distribution and abundance in response to physical and biological processes on the continental shelf of southeastern USA.** Pomeroy, L.R.; Atkinson, L.P.; Blanton, J.O.; Campbell, W.B.; Jacobsen, T.R.; Kerrick, K.H.; Wood, A.M. (Univ. of Georgia, Athens). *Continental Shelf Research;* **2**: No. 1, 1-20(1983).

The distribution and abundance of bacteria and phytoplankton on the continental shelf of the southeastern United States were observed in relation to physical processes. Phytoplankton produc-

tion was influenced by inputs of water of reduced salinity from the estuaries and by inputs of high salinity, low-temperature water from the west front of the Gulf Stream. The distribution of chlorophyll suggests that in each case production is influenced both by inputs of nutrients and by the enhanced vertical stability associated with the stratification of waters of different densities. The standing stock of bacteria on the inner shelf, 10^6 ml^{-1}, is little changed by the influx of water of reduced salinity. On the outer shelf, where the usual standing stock of bacteria is 10^5 ml^{-1}, the numbers increase to 10^6 ml^{-1} in and above intrusions of Gulf Stream water in which phytoplankton blooms have developed, suggesting that the bacteria respond to products of both phytoplankton and zooplankton production. Adenylate energy charge values in the waters of the southeastern shelf are variable and volatile. At times values of 0.7 to 0.8 are widespread over most of the shelf, while at other times values < 0.6 are common, with localized patches of high values. Both autotroph-dominated and heterotroph-dominated microbial communities show these variations.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 5203004363, 4369, 4382, 4391, 4392, 4393, 4585, 4757, 5066, 5067, 5221, 5230, 5286, 5339, 5340

5407 **(AERE-G—3149) Aqueous phase transport through granitic rocks.** Bradbury, M.H.; Green, A. (UKAEA Atomic Energy Research Establishment, Harwell. Chemical Technology Div.). Mar 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780218.

Using Scottish granites of UK origin it has been established that : (1) pore connectivity exists over metre distances and does not vary significantly with distance. (2) The formation factor may show an increase by a factor of approx. 2 for thin samples (approx. 1 cm). Since diffusion samples are of this order of thickness, laboratory measurements may be overestimating the diffusion coefficient appropriate for use in migration model calculations by a factor of approx. 2. (3) The effect of confining pressures up to approx. 16 MPa is to reduce diffusion coefficients by 50 to 60%. This implies that diffusion coefficients appropriate to granite at depths of approx. 500 m are approximately a factor of two lower than those obtained in the laboratory. (4) Diffusion rates through weathered fissure surfaces can be significantly greater (up to approx. 200 times) than through 'good' rock and are strongly dependent on the severity of the weathering. No evidence for pore blocking by weathering products was found. (5) Latex colloids having a diameter of 0.312 μm neither cause pore blocking nor do they penetrate the pore structure.

5408 (FS—83-30-T, pp 373-380) **Techniques for radioactivity measurement in water, suspensions and sediments.** Krause, W.J.; Mundschenk, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The measurements to determine the overall α-radioactivity in surface water and sediment samples are intended as monitoring measurements to reveal long-term trends, as well as to detect uncontrolled release of radioactivity. The measurements to determine the overall β-radioactivity in surface water and sediment samples are likewise a monitoring method to detect all radioecologically relevant nuclides in one process. This method can be applied under certain conditions as a means of controlling whether the dose limits set in section 45 of the Radiation Protection Ordinance are exceeded. Liquid scintillation spectrometry is usually applied to detect tritium within the framework of environmental monitoring. Gamma spectrometry using Ge(Li) detectors allows simultaneous determination of various radionuclide fractions in complex nuclide compositions. For this purpose, large-volume water samples have to be pre-treated because of their very low nuclide concentrations (50-100 l). Radioactivity release after incidents has to be controlled by direct measurement, using appropriate counting systems (ring dishes). Radionuclides are primarily adsorbed by suspended particles where they can be detected and measured with great sensitivity, just as in sediments.

5409 (FS—83-30-T, pp 381-384) **Anticompton spectrometry to determine activity concentrations in surface water.** Huebel, K.; Huettner, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

An anticoincidence unit shielded with lead is used to lower the detection limit of radionuclides in surface water (about 0.04 pCi Cs=137/l in a high-power, conventional Ge(Li) detector with a relative sensitivity of 35%). The 2 π half-space below the dose is measured by a Ge(Li) detector, while the upper half-space is measured by nine NaI crystals. This way, interference impulses due to Compton scattering are suppressed. 'Simultaneous' impulses arriving within a certain interval are suppressed by an anticoincidence circuit. Using a Cs-137 preparation, a peak/Compton ratio of 450 is obtained.

5410 (FS—83-30-T, pp 395-398) **Detection of C-14 in surface water.** Huebel, K.; Litzke, J. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

In an absorption tube, the carbon dioxide is obtained from 9.5 g of barium carbonate, suspended in degassed water and with phosphoric acid being admixed; adsorption proceeds in a mixture of methanol and an aminoalcohol. The scintillator to be added consists of PPO, POPOP, naphthalene and toluol. A liquid scintillation spectrometer with fixed adjustment in the C-14 measuring channel (window width: 4.4-150 keV) will yield optimum results. With a background of 17 cpm and a measuring period of 1200 minutes, a counting efficiency of 61.3% and a chemical efficiency of 76%, plus a mean carbon amount of 50 mg/l, this method is successful down to a detection limit of 0.03 pCi/l (1.960), or 0.55 pCi/gC. (corresponds to 9% modern).

5411 **(IAEA-R—2463-F) Development of a method for direct gamma-spectroscopy measurements of the gamma-radioactivity of natural waters. Part of a coordinated programme on radiological and environmental protection studies in the Danube river catchment area. Final report for the period 1 December 1979 - 31 October 1982.** Manouchev, B. (International Atomic Energy Agency, Vienna (Austria)). Apr 1983. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703251.

In the present paper the possibilities of the direct gamma spectrometry in natural waters are discussed. The methods of theoretical and experimental determination of the detector-system sensibility are suggested. Gamma-field spectra taken in natural basins in Bulgaria are given. It is recommended to use the suggested methods in the design of a system for a continuous automatic control of the natural waters radiation purity.

5412 **(IOS-Rep—178) Sedimentation studies relevant to low-level radioactive effluent dispersal in the Irish Sea. Part III. An evaluation of possible mechanisms for the incorporation of radionuclides into marine sediments.** Kirby, R.; Parker, W.R.; Pentreath, R.J.; Lovett, M.B. (Institute of Oceanographic Sciences, Taunton (UK)). 1983. 66p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85780097.

Based on circumstantial evidence the Cumbrian mud area was previously interpreted as accretionary. There are no measurements confirming that riverborne sediment reaches the mud area and the postulated subtidal sources appear to be sealed by a lag gravel. In contrast, fine sediment deposited in Liverpool Bay is known to return to the Ribble, Mersey and Dee. Similarly 'hot' particles originating in the Sellafield outfall are implied to travel, perhaps accompanied by natural fine sediment, into the Ravenglass Estuary and elsewhere. The likely interpretation is that fine sediment accumulating in the coastal zone of the eastern Irish Sea is partly derived from seawards. Possible sources are coast erosion

and the unconsolidated mud areas themselves. Radionuclide profiles from the Cumbrian mud area have previously been interpreted as confirming the accretionary hypothesis. In fact three principal types of radionuclide profiles occur, which are interpreted here to indicate progressively more efficient bioturbation. Burrowing animals may also supply uncontaminated sediment to the bed, where it absorbs radionuclides before, in part, being redeposited locally. This implies that no large external sediment source is necessary to explain the radionuclide profiles encountered. We thus interpret the area as a relatively stable sedimentary regime dominated by biological processes.

5413 **(OSU—80-00123) Patterns of groundwater flow, pH, and electrical conductance in the Nordic west arm tailings, Elliot Lake, Ontario.** Blackport, R. (Waterloo Univ., Ontario (Canada). Research Inst.; Department of Energy, Mines and Resources, Elliot Lake, Ontario (Canada). Elliot Lake Lab.). 25 Nov 1980. 98p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85780098.

Prepared for CANMET, Elliot Lake Laboratory, by Waterloo Research Institute.

The prime objective of the field investigation reported was to install a groundwater monitoring network in and below the west arm Nordic tailings in order to determine the general directions of groundwater flow within the tailings, provide a basis for calculation of the groundwater flux into and out of the tailings, and provide a groundwater sampling network. Areas of upward, downward, and horizontal flow were found. In some areas seepage from the tailings enters the sand aquifer beneath the tailings, and in other areas the seepage enters the permeable bedrock. The chemical composition of pore water in the tailings is variable, in some places highly acidic. The general trends in hydraulic head and gradient were delineated, but it was not possible to define groundwater flow paths within and beneath the tailings, or to carry out mass balance studies.

5414 **(PB—84-233493) Sedimentation studies relevant to low-level radioactive effluent dispersal in the Irish Sea. Part 3. An evaluation of possible mechanisms for the incorporation of radionuclides into marine sediments.** Kirby, R.; Parker, W.R.; Pentreath, R.J.; Lovett, M.B. (Institute of Oceanographic Sciences, Wormley (UK)). 1983. 68p. NTIS, PC E05/MF E05.

See also PB83-259135.

Based on circumstantial evidence the Cumbrian mud area was previously interpreted as accretionary. There are no measurements confirming that riverborne sediment reaches the mud area and the postulated subtidal sources appear to be sealed by a lag gravel. In contrast, fine sediment deposited in Liverpool Bay is known to return to the Ribble, Mersey and Dee. Similarly 'hot' particles originating in the Sellafield outfall are implied to travel, perhaps accompanied by natural fine sediment, into the Ravenglass Estuary and elsewhere. The likely interpretation is that fine sediment accumulating in the coastal zone of the eastern Irish Sea is partly derived from seawards. Burrowing animals may also supply uncontaminated sediment to the bed, where it absorbs radionuclides before, in part, being redeposited locally. This implies that no large external sediment source is necessary to explain the radionuclide profiles encountered.

5415 (ZfI-Mitt—80, pp 57) **Isotope hydrologic and hydrochemical characterization of lakes around the Schirmacher oasis (East Antarctica).** Richter, W.; Wand, U.; Strauch, G.; Kowski, P.; Kurze, W. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5416 (ZfI-Mitt—80, pp 58) **Isotope glacial investigation on elucidating the origin of the glacial ice south of the Schirmacher oasis (East Antarctica).** Hermichen, W.D.; Kowski, P. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5417 (ZfI-Mitt—80, pp 64-65) **Hydrogeologic interpretation of isotope data concerning mass transport processes.** Jordan, H.; Hebert, D.; Froehlich, K.; Gellermann, R.; Scholz, R.P. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften; Bergakademie Freiberg (German Democratic Republic). Sektion Physik). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5418 (ZfI-Mitt—80, pp 84-85) **Distribution of ^{90}Sr and ^{137}Cs in Baltic sea waters 1975 to 1982.** Weiss, D.; Ettenhuber, E. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5419 (ZfI-Mitt—80, pp 114) **Isotope hydrological and hydrochemical characterization of an Antarctic subsea.** Hermichen, W.D.; Grelle, M.; Kurze, W.; Kowski, P.; Wand, U. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 5204005303, 5399

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 5205004213

5206 Regulations

REFER ALSO TO CITATION(S) 5206005355

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

5420 **(NP—5900277) Can an oil discovery lead to a recession.** Neary, J.P.; van Wijnbergen, S. (University Coll., Dublin (Ireland). Dept. of Political Economy; World Bank, Washington, DC (USA)). Nov 1983. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900277.

In this note we amend a previously published analysis of the potential recessionary impact of higher oil revenues by incorporating a direct wealth effect on asset markets. Clearly, with a strictly positive wealth elasticity of money demand, higher wealth leads to an incipient excess demand for money after an oil discovery; to ac-

commodate this the real money stock has to rise. This leads first to a greater appreciation of the exchange rate and to a lower post-shock equilibrium price level than in the case previously considered. In fact we show that the possibility of an actual decline in the domestic price cannot be ruled out. In that case higher oil revenues lead to a recession even without a spending lag; moreover, if there is a spending lag we show that the recession induced by the nominal exchange rate appreciation taking place up front will not be followed by a boom once spending responds but will continue past that time instead. The root of the problem is that the direct wealth effect of higher oil wealth increases the demand for money, which, given the nominal money supply, subjects the economy to a contractionary shock which may be sufficiently great to offset the direct expansionary effects of the oil discovery on domestic spending. The policy conclusion is obvious: an accommodating monetary policy will avoid the recession without undue inflationary pressure. 9 references, 2 figures.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 5302005355

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 5303004695

5421 **(DOE/EIS—0048-FS-1) Proposed fiscal year 1976 program facility location, Okanogan area service, Douglas and Okanogan Counties, Washington. Final supplement, Final Environmental Impact Statement.** (USDOE Bonneville Power Administration, Portland, OR). Jan 1980. 136p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85003133.

This document describes a proposal for transmission facilities to serve the Okanogan Valley. The original need for additional energy was determined in 1973 and discussed in a location supplement to the Fiscal Year 1976 Program Environmental Statement. The proposed plan of service is 55 miles (88 km) long, beginning at Chief Joseph Substation, continuing to a new proposed Coleman Butte Substation, and following the existing Okanogan-Tonasket 115-kV line to Tonasket Substation. The proposed route crosses the Colville Indian Reservation and has few conflicts with natural resources. This route also has few economic, engineering, or environmental impacts, is less expensive, and shorter than other routes. Therefore, it has been selected as BPA's plan of service. 45 references, 7 figures, 4 tables.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5422 **HCH-1 model of enzymatic cellulose hydrolysis.** Holtzapple, M.T.; Caram, H.S.; Humphrey, A.E. (Army Natick R & D Laboratories, MA). *Biotechnology and Bioengineering;* **26**: No. 7, 775-780(1984). Contract AC02-76ET20025.

Solka Floc BW200 was enzymatically hydrolyzed in a batch reactor using a commercial cellulase preparation. A total of 50 different hydrolysis conditions were run within a 10-fold range in enzyme concentration and a 30-fold range in cellulose concentration. The data were evaluated in three ways using five different models. Previous literature models were not as successful in correlating the data as the HCH-1 Model derived in this work.

5501 Behavioral Biology

5423 **Wet coastal plain tundra I.** Myers, J.P.; Swarth, C.W.; Pitelka, F.A. (Univ. of California, Berkeley). *American Birds;* **34**: No. 1, 81-83(Jan 1980).

This year's census data for the wet coastal plain tundra in Alaska; North Slope Borough 3 km due S of Naval Arctic Research Laboratory, Barrow; 71° 18'N, 156° 42'W, Barrow Quandrangle, USGS, reflect a 42% increase above the 5-year average in total species. There was a total of 17 species; 54 territorial males or females (164/km², 66/100 acres). There was an increase in breeding species which parallels a jump in breeding density although the new species comprise an insignificant fraction of the highest recorded and is 15% above the 5-year average; 10 species increased above last year's total while 3 decreased. It is speculated that regional melt-off patterns in relation to the timing of bird migration played a significant role in inter-year variations in breeding bird density.

5424 **Arctic low foothills tundra.** Myers, J.P.; Shuford, W.D.; Evens, J.; Pitelka, F.A. (Univ. of California, Berkeley). *American Birds;* **34**: No. 1, 82-83(Jan 1980).

This year's census data for the Arctic low foothills tundra in Alaska; North Slope Borough, 5 km ESE of Atkasook; 70° 27'N, 157° 19'W, Meade River Quandrangle, USGS, reflect a continued downward trend in total species and total breeding density. There was a total of 14 species: 39.5 territorial males or females (158/km², 64/100 acres). The drop in species number is not linked to any particular group. Two new species, Greater Scaup and N. Phalarope were added to the breeding list. The decrease in breeding density (down 16% from 1978 and 42% from 1977) was largely from a continued decline in Lapland Longspurs. Calculating the percent decline in total breeding density for all species except Lapland Longspurs reveals a 12% and 33% decline from 1978 and 1977, respectively.

5425 **Wet coastal plain tundra III.** Myers, J.P.; Gellman, S.T.; Pitelka, F.A. (Univ. of California, Berkeley). *American Birds;* **34**: No. 1, 83(Jan 1980).

This year's census data for the wet coastal plain tundra in Alaska; North Slope Borough, 3 km SSE of Naval Arctic Research Laboratory, Barrow; 71° 18'N, 156° 38'W; Barrow Quadrangle, USGS reflect a decrease in the total number of species breeding. However, total breeding density rose by 82%. Lapland Longspurs (up 105%) accounted for half of this increase while the rest was spread among many species. There was a total of 8 species; 40.5 territorial males or females (162/km², 66/100 acres).

5426 **Wet coastal plain tundra.** Myers, J.P.; McCaffery, B.J.; Pitelka, F.A. (Univ. of California, Berkeley). *American Birds;* **34**: No. 1, 83(Jan 1980).

This years's census data for the wet coastal plain tundra in Alaska; North Slope Borough, 3 km SSW of Naval Arctic Research Laboratory, Barrow; 71° 18'N, 156° 43'W; Barrow Quadrangle, USGS, reflect an increase in breeding species of 31% over the 5-year average, while breeding density was up 22%. Ten species increased and only 4 decreased. There was a total of 17 species; 61.5 territorial males or females (171/km², 69/100 acres).

5427 **Territoriality in non-breeding shorebirds.** Myers, J.P.; Connors, P.G.; Pitelka, F.A. (Univ. of California, Berkeley). *Studies in Avian Biology;* No. 2, 231-246(1979).

During the non-breeding season, many shorebirds defend feeding territories. The authors studies in coastal California and eastern Argentina examine the extent of shorebird winter territoriality, and describe its ecological content. Eleven species in California and 13 in Argentina defend territories for varying periods of up to several months' duration. The expression of territoriality differs in extent between species, individuals, and habitats, being most strongly developed in local populations foraging on the short-grass pampas and seasonal wetlands of coastal Argentina. Explanation of this variation may best be sought in terms of individual responses to local habitat conditions affecting the energetic costs and benefits of defending foraging sites. One such habitat parameter appears to be the length of time that local areas are available for foraging. Other hypotheses, such as preparing individuals for breeding behavior or decreasing predation risk, are considered and tentatively rejected.

5428 **Seasonal habitat use by Arctic Alaskan shorebirds.** Connors, P.G.; Myers, J.P.; Pitelka, F.A. (Univ. of California, Berkeley). *Studies in Avian Biology;* No. 2, 101-111(1979).

Shorebirds display a wide range in seasonal patterns of habitat use along the Arctic coast near Point Barrow, Alaska. Differences between species reflect habitat preferences, the timing of movements with respect to seasonal habitat availability, and wheth-

er the use is breeding, postbreeding, or migrational. During the breeding season (June and July), most activity is centered on the tundra, but by early August a marked coastal movement occurs, resulting in high densities of particular species in shoreline and adjacent habitats. In August and September, widespread use of littoral habitats develops, especially for such species as Red Phalarope, Ruddy Turnstone, and Sanderling. In contrast, Golden Plovers and Pectoral Sandpipers restrict most of their activities to the tundra. Other species exhibit intermediate patterns of habitat use. These patterns determine the dependence of each species on Arctic coastal habitats, and the susceptibility of each to disturbances related to outer continental shelf oil development.

5502 Biochemistry

5429 **(DOE/ER/12003—6) Investigation of the nature of semisynthetic esterases. Progress report, September 15, 1981-September 14, 1984.** Keyes, M.H. (Owens-Illinois, Inc., Toledo, OH (USA)). Apr 1984. Contract AC02-81ER12003. 38p. (COO—12003-6). NTIS, PC A03. File Number DE85003222.

Two semisynthetic esterases, an acid-esterase with a pH optimum of 6.0 and a neutral-esterase with a pH optimum of 7.5, were generated from bovine pancreatic ribonuclease. The method involved perturbation of ribonuclease at pH 3.0, subsequent conformational modification with indole propionic acid, and crosslinking the modified protein with glutaraldehyde. The two esterases generated by this procedure were separated and partially purified by ammonium sulfate fractionation. The neutral-esterase activity was predominantly precipitated at 40% ammonium sulfate saturation, and the acid-esterase at 70 to 90% ammonium sulfate saturation. Kinetic studies with the purified acid-esterase indicated that this semisynthetic esterase hydrolyzed several amino acid ethyl esters, but preferred ester containing an aromatic residue. The acid-esterase was competitively inhibited by L-tryptophan. This esterase also had low amidase activity towards benzoylarginine p-nitroanilide. Neutral-esterase showed a high degree of specificity toward L-TrEE and acetyl tryptophan ethyl ester. It had only very low activity towards BAEE and L-tyrosine ethyl ester (L-TEE). Moreover, this esterase had significant amidase activity toward N-acetyltryptophanamide (NATA). Neutral esterase was not inhibited by tryptophan. 18 references, 10 figures, 5 tables.

5430 **(DOE/ER/13140—T1) Cellulase: a key enzyme in fermentation. Progress report, 1983-1984.** Eveleigh, D.E. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Biochemistry and Microbiology). 27 Apr 1984. Contract AS05-83ER13140. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003242.

Progress has been achieved in three areas. N-glycosylation has been shown not to be absolutely essential for maintenance of activity of cellulase enzymes through both inhibitor (Tunicamycin) and enzyme (Endo-H) degradative studies. Thus deglycosylated cellulase may be functional as a direct transcript from mRNA. However, initial studies of in vitro synthesis of cellulase, though yielding positive cellulase antibody proteins, did not produce enzymatically active forms. These proteins produced in vitro were considerably larger than the in vivo form. Further clarification of the in vitro system is underway. Attempts to produce monoclonal antibodies have been successful with selection of clones that show antibodies specific towards cellobiohydrolase. Polyclonal antibodies in contrast do not show such specificity. The monoclonal preparations should allow development of direct assays for cellobiohydrolase, an enzyme for which no direct assay currently exists.

5431 **(DOE/EV/05854—7) Repair of lesions and initiation of DNA replication in vertebrate cells. Annual progress report, 1984, and proposal for 1985-1986.** Taylor, J.H. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). 1984. Contract AS05-78EV05854. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003073.

Progress is reported in the following areas: (1) the isolation, sequencing and characterization of dispersed repeats homologous to a Xenopus replication enhancer; (2) studies of initiation and replication of plasmids in vitro with extracts from Xenopus eggs; and (3) repair of base pair mismatchs at the Hpa II locus in SV40 virus. 11 references. (ACR)

5432 **(LA-UR—84-3339) Davydov solitons in polypeptides.** Scott, A. (Los Alamos National Lab., NM (USA)). Oct 1984. Contract W-7405-ENG-36. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002436.

The experimental evidence for self-trapping of amide-I (CO stretching) vibrational energy in crystalline acetanilide (a model protein) is reviewed and related to A. S. Davydov's theory of solitons as a mechanism for energy storage and transport in protein. Particular attention is paid to the construction of quantum states that contain N amide-I vibrational quanta. It is noted that the N = 2 state is almost exactly resonant with the free energy that is released upon hydrolysis of adenosine triphosphate. 30 references, 4 figures, 3 tables.

5433 **(LA-UR—84-3396) Bimolecular dynamics by computer analysis.** Eilbeck, J.C.; Lomdahl, P.S.; Scott, A.C. (Los Alamos National Lab., NM (USA); Heriot-Watt Univ., Edinburgh (UK). Dept. of Mathematics). 1984. Contract W-7405-ENG-36. 23p. (CONF-8409167—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002417.

From Joint Nordic Council for Research Policy and International Institute for Applied Systems Analysis symposium on applied mathematics, systems; Geilo, Norway (17 Sep 1984).

As numerical tools (computers and display equipment) become more powerful and the atomic structures of important biological molecules become known, the importance of detailed computation of nonequilibrium biomolecular dynamics increases. In this manuscript we report results from a well developed study of the hydrogen bonded polypeptide crystal acetanilide, a model protein. Directions for future research are suggested. 9 references, 6 figures.

5434 **(UCLA—1260) Annual progress report, July 1, 1983-June 30, 1984.** (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). 1984. Contract AC03-76SF00012. 76p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85002518.

Research in the Laboratory of Biomolecular and Celluler Sciences deals with proliferation, gene expression and differentiation in normal cells and in cells exposed to pollutants, carcinogens or tumor promoters. The research program of the Laboratory of Environmental Biology presents an integrated approach to studies of the functional interactions of the physical and biotic components of arid land ecosystems. Nuclear Medicine research has focussed on development of positron emission tomography, preparation of short-lived isotopes of oxygen, nitrogen, carbon and fluorine, use of these isotopes to label physiological substrates, tracer studies of cerebral biochemistry and physiology, measurement of regional myocardial fatty acid metabolism and blood flow. (AER)

5435 **(UCRL—52000-84-5) Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84013578.

Three articles and two briefs discuss ongoing research at Lawrence Livermore National Laboratory. Topics in this issue include: construction of human chromosome library (brief); dispersion of liquified gases (brief); magma evolution; energy flow diagrams; and computer simulation of particulate flow.

5436 **Apoprotein E is synthesized and secreted by resident and thioglycollate-elicited macrophages but not by pyran copolymer- or bacillus calmette-guerin-activated macrophages.** Werb, Z.; Chin, J.R. (Univ. of California, San Francisco). *Journal of Experimental Medicine;* **158**: 1272-1293(Oct 1983).

A macrophage secretes more than 60 polypeptides, including apoprotein E, fibromectin, complement factor B, plasminogen activator, and other proteinases. Secreted proteins are particularly sensitive to alteration in response to inflammation. Because there are differences in the secretion of neutral proteinses by macrophages in different functional states, an attempt has been made to determine whether the secretion of other proteins varies according to the quiescent, activated, or inflammatory state of the macrophage. Results

indicate that apoprotein E is synthesized by resident macrophages and by inflammatory macrophages elicited with nonspecific stimuli, but is not synthesized by the hydrogen-peroxide producing, immunologically activated macrophages.

5437 **Effects of abnormal cytoskeletal structure on erythrocyte membrane mechanical properties.** Waugh, R.E. (Univ. of Rochester Medical Center, NY). *Cell Motility;* 3: 609-622(1983). Contract AC02-76EV03490.

Measurements of the mechanical properties of the erythrocyte membrane provide a direct assessment of the proper function of its structural components. To assess the effects of alterations in molecular structure on membrane mechanical properties, measurements have been performed on cells from six individuals whose membranes contain inherited, biochemically characterized structural defects. Because the contribution of the membrane skeleton to the mechanical behavior of the membrane is most evident in shear deformation, mechanical experiments were performed to measure the material constants which characterize the response of the membrane to shear force resultants. Generally, it was found that when the molecular defect is found to occur in a region of the skeleton which is stress-supporting, the maximum elastic strength of the membrane is reduced. However, the magnitude of the reduction can be quite different for membranes having similar or even identical defects. In some cases the differences can be attributed to the removal of the most fragile cells of the population by the spleen, but other results indicate that the biochemical description of the defects may be incomplete. These results emphasize the need for further refinements both in the biochemical characterization of membrane skeleton structure and in the description and measurement of membrane mechanical properties.

5438 **Synthesis of deoxyribonucleotidyl(3′5′)arabinonucleosides.** Gray, S.H.; Ainsworth, C.F.; Bell, C.L.; Danyluk, S.S.; MacCoss, M. (Univ. of Illinois, Chicago). *Nucleosides and Nucleotides;* 2: No. 5, 435-452(1983). Contract W-31-109-ENG-38.

Two different synthetic routes using phosphotriester methodology have been utilized to prepare deoxyribonucleotidyl(3′-5)arabinonucleosides containing 9-β-D-arabinofuranosyladenine (ara-A vidarabine) and 1-β-D-arabinofuranosylcytosine (ara-C, cytarabine) at the 3′-terminus in amounts and purity (greater than 95%) suitable for NMR analysis.

5503 Cytology

REFER ALSO TO CITATION(S) 5503005541

5439 **(CONF-8309280—1) Regulation of turnover of Na, K-ATPase in cultured cells.** Cook, J.S.; Karin, N.J.; Fishman, J.B.; Tate, E.H.; Pollack, L.R. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Oak Ridge (USA). School of Biomedical Sciences; Kentucky Univ., Lexington (USA). Dept. of Mathematics). Sep 1983. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001111.

From Society of general physiology; Woods Hole, MA, USA (11 Sep 1983).

This report concerns the dynamic state of cell surface membranes. Specific research areas discussed include: (1) membrane recycling in HeLa and HTC cells; (2) transit time and turnover of Na, K-ATPase; (3) up- and down-regulation of Na, K-ATPase; and (4) significance of regulation by turnover. 31 references. (ACR)

5440 **(CONF-8410185—1) Development of Na^+-dependent hexose transport in cultured renal epithelial cells (LLC-PK_1).** Weiss, E.R.; Amsler, K.; Dawson, W.D.; Cook, J.S. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002563.

From New York Academy of Sciences conference on membrane transport drive by ion gradients; New York, NY, USA (2 Oct 1984).

A number of factors were explored to analyze how they interact to yield the increasing transport capacity in differentiating cell populations. These factors include the number of functional transporters in the population, the distribution of these transporters among the individual cells, the Na^+ chemical gradient, the transmembrane potential, the pathways and activities of these pathways for efflux of glucoside, and cell-cell coupling between accumulating and non-accumulating cells. 35 references, 9 figures, 2 tables. (ACR)

5504 Genetics

5441 **Isolation and characterization of yeast DNA repair genes. I. Cloning of the RAD52 gene.** Schild, D.; Konforti, B.; Perez, C.; Gish, W.; Mortimer, R. (Univ. of California, Berkeley). *Current Genetics;* 7: 85-92(Spr 1983). Contract AC03-76SF00098.

The RAD52 gene of Saccharomyces cerevisiae has previously been shown to be involved in both recombination and DNA repair. Here the authors report on the cloning of this gene. A plasmid containing a 5.9 kb yeast DNA fragment inserted into the BamH1 site of the YEp13 vector has been isolated and shown to complement the x-ray sensitive phenotype of the rad52-1 mutation. The rad52-1 cells containing the plasmid form larger colonies than similar cells having lost the plasmid. This plasmid has been shown not to complement either the U.V. sensitivity or the recombination defect of the E. coli recA mutation. From the insert various fragments have been subcloned into the YRp7 and YIp5 vectors. Integration events of two of the subclones have been genetically mapped to the chromosomal location of RAD52, indicating that the structural gene has been cloned. A 1.97 kb BamH1 fragment subcloned into YRp7 in one orientation complements the rad52-1 mutation, while the same fragment in the opposite orientation fails to complement. Various other subclones indicate that a BglII site, within the BamH1 fragment, is in the RAD52 gene. This BglII site has been deleted by S1-nuclease digestion and the resulting deletion inactivates the RAD52 gene. BAL31 deletions from one end of a 1.9 kb Sal1-BamH1 fragment have been isolated; up to 0.9 kb can be deleted without loss of RAD52 activity, indicating that the RAD52 gene is approximately 1 kb or less in length.

5505 Metabolism

5442 **(DOE/ER/13188—1) Nitrogen control of photosynthetic protein synthesis. Progress report, November 1984.** Schmidt, G.W. (Georgia Univ., Athens (USA). Research Foundation). Nov 1984. Contract FG09-84ER13188. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003513.

The objective of this study is to understand the molecular relationship between nitrogen nutrition and the synthesis of photosynthetic proteins in Chlamydomonas reinhardtii. Most of the effort has concerned development of analytical techniques and reagents to be used in studies of the effects of nitrogen deficiency on chloroplast biogenesis and the responses of such cells to nitrogen provision. These techniques are summarized.

5443 **(EPRI-EL—3581, pp 4.71-4.100) Biotechnology potential as a PCB disposal option: an overview.** Peyton, T.O.; Terhorst, E.G. (American Tech. Management Consultants, LaFayette, IN). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Electric utilities must comply with EPA requirement under the Toxic Substances Control Act for the eventual disposal of about one billion (10^9) gallons of utility equipment fluids containing polychlorinated biphenyl (PCB). EPA requirements also address leaks and spills and the need for clean-up and disposal of contaminated environments. PCB in electrical equipment is composed of over 100 chlorinated biphenyl compounds all of which have been reported to be degraded by mixed cultures of natural bacteria. However, under natural conditions, the more highly chlorinated PCB compounds (those which contain a high weight percent chlorine) biodegrade far slower than compounds with less chlorine. Since the highly chlorinated congeners make up a large portion of

the utility PCB inventory, rates of biodegradation must be enhanced to make biotreatment techniques competitive with other disposal means. Methods such as emulsification and genetic engineering could accomplish this enhancement. The electric utility's use of PCB and disposal requirements, existing evidence of PCB biodegradation, means of improving the performance of biological systems (i.e., genetic engineering), and biotreatment technologies are reviewed. It is concluded that biotreatment of both spills and the planned phase-out of existing equipment inventories of PCB fluids are feasible given adequate research and development.

5444 (ZfI-Mitt—77, pp 16) **Comparison of different ^{15}N tracers and modes of application in determining kinetic parameters of whole-body protein metabolism.** Krawielitzki, K.; Schandereit, R.; Evers, B.; Bock, H.D. (Akademie der Landwirtschaftswissenschaften der DDR, Dummerstorf-Rostock. Forschungszentrum fuer Tierproduktion). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5445 (ZfI-Mitt—77, pp 27) **Studies on determination of protein quality under conditions of maintenance in ^{15}N-labelled laboratory animals.** Bergner, H.; Simon, O.; Bergner, U.; Adam, K. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Tierproduktion und Veterinaermedizin). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5446 (ZfI-Mitt—77, pp 28) **Determination of chyme endogen nitrogen by ^{15}N tracer technique.** Gebhardt, G.; Koehler, R.; Souffrant, W.B. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Tierproduktion und Veterinaermedizin). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5447 (ZfI-Mitt—77, pp 33) **Amino acid requirements in metabolism determined using ^{15}N-amino acids.** Muenchmeyer, R.; Bergner, H.; Simon, O.; Adam, K. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Tierproduktion und Veterinaermedizin). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5448 **Oxygen consumption of the larvae of the decapod crustaceans, Emerita talpoida (Say) and Libinia emarginata Leach.** Schatzlein, F.C.; Costlow, J.D. Jr. (California State Univ., Long Beach). *Comparative Biochemistry and Physiology [Part] A: Comparative Physiology;* **61**: 441-450(1978). Contract AS05-76EV14377.

The oxygen consumption (V/sub O_2/) of laboratory reared Emerita talpoida and Libinia emarginata was measured at 5°C intervals (15-35°C). The V/sub O_2/ of E. talpoida larvae was twice that of similarly sized L. emarginata larvae. The maximum V/sub O_2/ for both species was at 25°C, but E. talpoida - older than stage III - had maximum rates at 30°C. E. talpoida cultured at 25 or 30°C had a similar V/sub O_2/. Growth, but not molting, stopped at Stage VI zoea in E. talpoida but the V/sub O_2/ diminished after these molts.

5506 Medicine

REFER ALSO TO CITATION(S) 5506005060, 5060, 5061, 5216, 5229, 5434, 5465, 5473, 5475, 5477, 5507, 5520, 5968, 5969

5449 **(DOE/ER/60056—T1) Use of single photon emission tomography for quantitative imaging. Progress report for the period since February 1983.** DeNardo, S.J. (California Univ., Davis (USA). School of Medicine). 31 Jan 1984. Contract AT03-82ER60056. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84015482.

A brief outline of research progress is presented. Studies focussed on the use of single photon emission tomography for quantitative imaging and the development of labelled antibodies using iodine 123 and copper 67. (ACR)

5450 (FS—83-30-T, pp 249-252) **Selected radiation protection measures in a large-scale hospital, illustrated by the example of the Medizinische Hochschule Hannover.** Junker, D.; Fitschen, J. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5451 (FS—83-30-T, pp 385-389) **Radioactivity monitoring of waste water from isotope laboratories.** Arndt, J.; Fusban, H.U.; Gans, I.; Ruehle, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Due to the fact that radionuclide concentration measured in samples taken from the local sewage system do not yield information on any possible offense against section 46, sub-section (4) of the Radiation Protection Ordinance, the procedure should be modified so as to provide for frequent sampling of waste water at the site of isotope-handling institutes or laboratories, and for comparative measurements to be made. For efficient radioactivity monitoring in sewage treatment works receiving waste water from a large number of potential polluters, continuous sampling at various stages of the treatment process is suggested, together with recurrent single-nuclide analyses. These may be supplemented by sewage sludge analyses, as the radionuclides are accumulated in the sewage sludge. Various means of efficient waste water monitoring are explained by some examples.

5452 (FS—83-30-T, pp 431-442) **Incorporation monitoring by direct measurement of body radioactivity in medical personnel.** Werner, E.; Kunkel, R.; Erlenbach, H.R.; Goerlich, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The results presented show that incorporation monitoring is necessary. The data will help the persons responsible for radiation protection to improve occupational safety. Regular incorporation monitoring will induce workers to more reliably observe radiation protection rules. Continuous incorporation monitoring is not always possible, nor is it really necessary, as experience has shown. It is not possible to accurately determine the radioactivity received by the body from the measured body activity and the resulting body dose. The risk of incorporation varies with field of work or different types of nuclides or compounds. The highest risk is incurred with nuclides in volatile state, or with frequent handling of Tc-99m for therapeutic purposes. Incorporation of radionuclides declined within the last 10 years, both in terms of frequency and activity. Incorporation monitoring will further contribute to this trend, but further developments in nuclear medicine and research will pose new problems.

5453 (FS—83-30-T, pp 557-560) **Comparison of personnel monitoring data with the radiation dose after a radiation accident, determined by biological methods.** Stephan, G.; Hadnagy, W.; Chang, T.P. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Chromosomal aberrations are found to be useful indicators of radiation exposure, even in the low dose range and long after the exposure. Exposures to excess doses are presented in a table; all cases were described in relevant publications, and biological and physical dose estimations were carried out.

5454 **(IAEA-R—3376-F) Efforts for improvement in radiotherapy of cancer using metronidazole with special regard to head and neck. Part of a coordinated programme on improvement of cancer therapy by the combination treatment of conventional radiation and physical and chemical means. Final report for the period 1 March 1983 - 29 February 1984.** Patricio, M.B. (International Atomic Energy Agency, Vienna (Austria)). Mar 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703263.

A great effort has been expended in the search for means which would be of immediate practical interest to the radiotherapist in order to achieve improvement of the result of cancer treatment. These means include modifiers which are sensitizers to potentiate radiation effects on tumour cells without affecting normal tissue. We started a controlled therapeutic trial on locally advanced head and neck carcinomas using metronidazole. There was good tolerance to metronidazole although improvement of local tumour control with this drug was not observed. We also observed that irradiation with fractions daily gave a better tumour control than single fractions a day.

5455 **(IFIN-RB—6-1981) Medicina nucleara: introducerea in computerizarea investigatiei in vivo cu radionuclizi.** Mateescu, Gh.; Dumitriu, L.; Notas, E. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1981. 40p. (In Romanian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780206.

Firstly some basic aspects of nuclear medicine in vivo procedures along with the requirements for digital data handling in scintigraphic process are synthetically presented from the technical point of view. The essential features needed to interface an usual (Anger) gamma camera to a general-purpose computer are next underlined also emphasizing that an optional configuration for a computerized scintigraphic system could be implemented using a CORAL-4q11 minicomputer. Finally a system of programs, termed GAMMA-11, extensively used for scintigraphic studies is described together with a set of original algorithms which have been implemented as new FORTRAN programs and modularly included within this system.

5456 **(PB—84-169150) Rutherford Appleton Laboratory's Mark I multiwire proportional counter positron camera.** Bateman, J.E.; Connolly, J.F.; Stephenson, R.; Tappern, G.J.; Flesher, A.C. (Rutherford Appleton Lab., Chilton (UK)). 1983. 60p. (RL—83/113). NTIS, PC E04/MF E04.

A small (30 cm x 30 cm) model of a proposed large aperture positron camera has been developed at Rutherford Appleton Laboratory. Based on Multiwire Proportional Counter technology it uses lead foil cathodes which function simultaneously as converters for the 511 keV gamma rays and readout electrodes for a delay line readout system. The detectors have been built up into a portable imaging system complete with a dedicated computer for data taking, processing and display.

5457 **(PB—84-220227) Quantitation of PTH (parathyroid hormone) in biological fluids. Draft report.** Hindman, B.E.; Halpern, E.P.; Schlaff, S.; Mason, R. (Franklin Research Center, Philadelphia, PA (USA)). Jan 1982. 84p. NTIS, PC A05/MF A01.

See also PB84-220219.

Radioimmunoassay -- rather than immunoradiometry, bioassay or cytochemical assay -- is the PTH determination of the future. The commercially available radioimmunoassays have been developed with nonhuman reagents. Those using antisera that react with C-terminal circulating fragments distinguish normal from hyperparathyroid subjects better than those that recognize the intact PTH. The i-PTH has utility in selective venous catheterization for preoperative localization of hyperfunctioning parathyroid tissue. However, the ability of these antisera to detect human N- and C-terminal fragments has been determined by using bovine PTH fragments, since fragments of human PTH are not commercially available. The production of antibodies by humans or animals is dependent on the injected antigen causing the host to make antibodies. Antibody may not only differ from species to species but from individual to individual within the same species. Antibody differences can also be encountered from one immunization to another. These factors account for the nonspecificity and noncorrelation differences between assays, and do not reflect the true in vivo situation.

5458 **(PB—84-235381) Colloquium on the toxicity of radionuclides. 19-20 November 1982.** (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Feb 1984. 138p. (BLG—563). NTIS, PC E08/MF E08.

Within the frame of a research project we examine the appearance and the distribution of radioactive substances by the medical use at the University Hospital Homburg. The clinic, with more than 2000 beds, has 14 departments in which radioactive substances are used. The number of the used nuclides totals to 76, however, only 15 nuclides are used in activities exceeding 1 mCi per year. The total acquisition of the clinic amounts about 100 Ci in a year, at which most frequently were used 131I, 123I and 99Mo. At 4 departments of the clinic there is worked regular with Tritium. The annual consumption amounts about 0,2 Ci.

5459 **(PTB-Dos—9) Photon and electron dosimetry at the Physikalisch-Technische Bundesanstalt in Braunschweig.** Reich, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Gruppe Photonen- und Elektronendosimetrie). Dec 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750008.

The PTB is charged by the government to prepare the legal control for dosimeters used in radiotherapy and radiation protection by setting up requirements for type approvals and by developing the technical prerequisites for performing type tests. Based on international recommendations, the change of units had to be connected with a change of quantities. The exposure had to be changed either to kerma or to absorbed dose or to dose equivalent.

5507 Microbiology

5460 (EPRI-EL—3581, pp 4.101-4.118) **Bacterial degradation of PCBs: evidence of distinct pathways in Corynebacterium sp. MB1 and Alcaligenes eutrophus H850.** Bedard, D.L.; Brennan, M.J.; Unterman, R. (General Electric Corporate Research and Development, Schenectady, NY). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

More than 100 forms (congeners) of polychlorinated biphenyls (PCBs), differing in the number and position of chlorines, have been used over the last half century. The same properties which formed the basis for their use (thermal stability, chemical stability) have also contributed to their accumulation in the environment. Furthermore, PCBs are highly insoluble in water and are only slightly mobilized by aqueous systems. Thus, PCBs have accumulated in soil and lake and river sediment at sites of their production, use, storage, or disposal. Furukawa and colleagues have convincingly demonstrated the ability of two pure bacterial cultures, Alcaligenes Y42 and Acinetobacter P6, to degrade pure PCB congeners containing up to five chlorine atoms. The ability of these cultures to degrade a broad range of PCB congeners has prompted questions about the origin of PCB degradative competence in bacteria and the enzymatic pathways involved. An in-depth study of the biochemistry and genetics of bacterial PCB degradation aimed at

providing a sound basis for understanding what is happening in the environment is described.

5461 **Immunology of methanogens: a new development in microbial biotechnology.** Macario, A.J.L.; Conway de Macario, E. (New York State Dept. of Health, Albany). *Immunology Today;* 3: No. 10, 279-284(Oct 1982). Contract AC02-81ER10880.

Methanogens are pleiomorphic: small and large cocci, rods of various lengths, and spirilla have been found. They also show an array of 16S rRNA codon catalogs and cell-wall compositions. Yet much of the genealogy, ecology and contribution to the environment remains unknown, and until recently knowledge of their antigenicity and immunogenicity was poor. But study of the immunology of methanogens has now begun, and in this article the ways in which that knowledge will contribute to the use of methonogens will be considered.

5509 Pathology

5462 (Zfl-Mitt—77, pp 18) **^{15}N isotope analysis of biological materials using the new ^{15}N analyzer NOI-6.** Jung, K.; Reinhardt, R.; Meier, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5463 (Zfl-Mitt—77, pp 19-20) **Chromatographic separation of NPN compounds in the analytical evaluation of ^{15}N tests in man with special reference to hepatopathies.** Hirschberg, K.; Jung, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Matkowitz, R. (Bezirkskrankenhaus Leipzig (German Democratic Republic). Chirurgische Klinik). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5510 Physiological Systems

REFER ALSO TO CITATION(S) 5510005434, 5523, 5524

5464 (Zfl-Mitt—77, pp 44) **Effect of antenatal hypoxia on the protein synthesis system in the rat brain.** Zhukova, T.P.; Sorokina, E.G.; Richter, I.; Plath, C. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Pediatrii; Rostock Univ. (German Democratic Republic). Bereich Medizin). Sep 1983. NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5465 **Direct binding of radioiodinated monoclonal antibody to tumor cells: significance of antibody purity and affinity for drug targeting or tumor imaging.** Kennel, S.J.; Foote, L.J.; Lankford, P.K.; Johnson, M.; Mitchell, T.; Braslawsky, G.R. (Biology Division, Oak Ridge National Laboratory, TN). *Hybridoma;* 2: No. 3, 297-310(1983).

For MoAb to be used efficiently for drug targeting and tumor imaging, the fraction of antibody binding to tumor cells must be maximized. We have studied the binding of 125I MoAb in three different tumor systems. The fraction of antibody that could be bound to the cell surface was directly proportional to the antibody purity. The affinity constant also limits the fraction of antibody that can bind to cells at a given antigen concentration. Rearrangement of the standard expression for univalent equilibrium binding between two reactants shows that in antigen excess, the maximum fraction of antibody that can bind (formula; see text). Binding data using four different MoAb with three cell systems confirm this relationship. Estimates for reasonable concentrations of tumor antigens in vivo indicate that antibodies with binding constants less than 10(8) M-1 are not likely to be useful for drug targeting or tumor imaging.

5520 Public Health

5466 (Juel-Spez—255, pp 154) **Routine duties.** Probst, H.J.; Uray, I.; Hintzen, H.J.; Krafft, K. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 5530005398

5467 **(DOE/ER/10895—T1) Basis for the competitiveness of Rhizobium japonicum in the nodulation of soybean.** Bauer, W.D.; Evans, W.R. (Battelle-Charles F. Kettering Research Lab., Yellow Springs, OH (USA)). 8 Jan 1982. Contract AC02-81ER10895. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003520.

The preliminary results on the nodulation of capacity of bacteria incubated in water suggest a passive role of the bacteria during initial stages of infection. Preliminary experiments required to verify the nodulation capacity of marked bacterial strains is complete. Competition experiments will soon be conducted to determine if growth pouches can be correlated with nodulation experiments under more field-like conditions.

5468 **(DOE/ER/10895—T2) Competitiveness of Rhizobium japonicum in the nodulation of soybean. Progress report.** (Battelle-Charles F. Kettering Research Lab., Yellow Springs, OH (USA)). 1983. Contract AC02-81ER10895. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003524.

The main objectives of the study were to determine the specific characteristics that make one strain of Rhizobia japonicum more competitive in its ability to nodulate soybean than another strain. No significant differences were identified between the strains tested with respect to relative rates of infection, however, there are significant differences in efficiency of infection. These differences in efficiency may be important in determining the outcome of direct competition between strains.

5469 **(DOE/ET/33626—T1) NMSU sewage sludge project: summary report, 1975-1982.** (USDOE Albuquerque Operations Office, NM). 1983. Contract AS04-76ET33626. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002992.

Research results for the period 1975 to 1982 are summarized. The tasks reported on include research activity in agronomy, animal science, soil chemistry, sheep biology, agricultural economics, and soil microbiology. (ACR)

5470 **(DOE/SR/00870—1-App.) Studies related to reclaiming borrow pits and denuded areas. Progress report.** (USDOE Savannah River Operations Office, Aiken, SC). 1977. Contract AI09-76SR00870. 5p. (SRO—870-1-App.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002210.

Three studies are summarized. Study topics include: (1) growth of container-grown loblolly pine with specific ectomycorrhizae in soil amended with sludge or fertilizer and lime; (2) growth response of loblolly pine with specific ectomycorrhizae in soil amended with sludge, flyash, tree bark or fertilzer and lime; (3) growth response of 2 families of sweetgum with specific endomycarrhizae in soil amended with different quantities of sludge. 2 tables.

5471 **(IAEA-R—2726-F) Study of pest-predator interaction in agricultural ecosystems by using neutron activation. Part of a coordinated programme on the use of isotopes in pest management with emphasis on rice insects. Final report for the period 15 November 1980 - 31 March 1984.** Szalay-Marzso, L. (International Atomic Energy Agency, Vienna (Austria)). Apr 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703256.

Several methods were investigated for using the stable element samarium, as a tracer to study insect predator/parasite-prey interactions. The element was introduced into parasite-prey by injection, by incorporation into artificial diet and by allowing prey to feed on labelled host plants. It is readily taken up by plants when in solution. Levels of samarium were found that were non-toxic to prey and that could be detected, by neutron activation, in parasites and predators that attacked the prey. Using samarium labelled prey, the author demonstrated in field tests that carabid beetles forage more efficiently for prey that are distributed horizontally than ones distributed vertically.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 5601205242, 5506

5472 **(ACRH—1000-35) Effect of bacteriophage infection on the sulfur-labeling of sRNA.** Hsu, W.T.; Foft, J.W.; Weiss, S.B. (Argonne Cancer Research Hospital, Chicago, IL (USA); Chicago Univ., IL (USA). Dept. of Biochemistry). Oct 1967. Contract W-31-109-ENG-38. 23p. NTIS, PC A02. File Number DE85000773.

Pulse-labeled studies of S^{35}-incorporation into E. coli RNA have been examined in normal and phage-infected cells. In both cases, S^{35} is incorporated into the sRNA fraction only. Chromatography on columns of MAK however reveals in a significant change in the S^{35}-RNA profile after T4 infection. The alteration in S^{35}-labeling of sRNA occurs early after viral infection and can be blocked by chloramphenicol if this is present prior to host cell infection. Only the T-even coliphages have been observed to effect these changes. The observed alterations after T4 infection do not appear to be attributable to changes in pre-existing host sRNA molecules. 12 references.

5473 **(AD-P—003858/8) Results of animal experiments as a basis for recommendations on therapy of combined injuries (radiation injury plus wounds).** Messerschmidt, O. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen, Neuherberg (Germany, F.R.). Lab. fuer Experimentelle Radiologie). 29 Apr 1983. 15p. NTIS, PC A02/MF A01.

This article is from 'Pathophysiology of Combined Injury and Trauma: Proceedings of the International Symposium (1st) Held at the Uniformed Services University of the Health Sciences, Bethesda, Maryland on 27-29 April 1983,' AD-A144 370, p36-50.

The treatment of combined injuries must always be seen against the background of the radiation syndrome therapy. All combined injuries have a set of symptoms in common; general treatment principles can be adjusted to these symptoms. Almost all additional injuries worsen the development and prognosis of the radiation disease. Radiation doses whose effects are far below the limit of lethality can become life endangering in the presence of serious injuries or burns. The susceptibility for shock is extremely increased. Not much is known yet about the combination injury shock in people; one can assume, however, that its treatment should be similar to that of a wound shock without additional exposure to irradiation. Warmth, quiet, control of pain, and stabilization of the circulatory system should be mentioned here. The healing of wounds, burns, and open fractures in the initial phase of the radiation disease does not always differ from the healing in non-irradiated patients; however, when the agranulocytosis starts, very serious wound infections can occur, which can even lead to necrosis. The method of choice is a primary wound suturing as soon as possible after the combined injury. Local and general antibiotic therapy should not be omitted.

5474 **(AD-P—003861/2) Effect of radiation and surgical trauma on gastrointestinal function.** Dubois, A. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 29 Apr 1983. 10p. NTIS, PC A02/MF A01.

This article is from 'Pathophysiology of Combined Injury and Trauma: Proceedings of the International Symposium (1st) Held at the Uniformed Services University of the Health Sciences, Bethesda, Maryland on 27-29 April 1983,' AD-A144 370, p78-87.

The response of the gastrointestinal tract to physical and psychological aggression is initially characterized by an inhibition of its motor and secretory activity. The subsequent response is highly variable and depends on the type and intensity of the stimulus. In the present review, we will consider only the effect of ionizing radiation and of surgical trauma on gastrointestinal motility and secretion.

5475 **(AD-P—003862/0) Care of thermally injured victims of a thermonuclear explosion.** Kaplan, J.Z. (Alta Bates Hospital, Berkeley, CA (USA). Burn Center). 29 Apr 1983. 10p. NTIS, PC A02/MF A01.

This article is from 'Pathophysiology of Combined Injury and Trauma: Proceedings of the International Symposium (1st) Held at the Uniformed Services University of the Health Sciences, Bethesda, Maryland on 27-29 April 1983,' AD-A144 370, p88-97.

Nuclear war or accidental non-hostile nuclear explosion would obviously rank among the greatest disasters to affect mankind. In addition to massive numbers of casualties, depending on the circumstances, our ability to care for these casualties might also be affected. Despite the predictions of doomsday soothsayers, nothing is accomplished by burying one's head in the sand. Therefore, we must give consideration to how victims of a thermo-nuclear explosion would be cared for.

5476 **(AD-P—003869/5) Canine hematopoiesis in a model of combined injury.** MacVittie, T.J.; Monroy, R.L.; Fink, M.; Gruber, D.F.; Patchen, M.L. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 29 Apr 1983. 24p. NTIS, PC A02/MF A01.

This article is from 'Pathophysiology of Combined Injury and Trauma: Proceedings of the International Symposium (1st) Held at the Uniformed Services University of the Health Sciences, Bethesda, Maryland on 27-29 April 1983,' AD-A144 370, p172-195.

The development of a large animal model for CI within the context of a nuclear disaster required that we describe, experimentally, the essential features of the radiobiology of acute effects in the canine. The large-animal model is also appropriate for assessing the immunologic, pharmacologic, and surgical modes of intervention of following CI. The canine model of CI at the AFRRI has stressed three developmental aspects: (a) establishing the radiobiology of the canine hemopoietic system, (b) choosing a relevant model for peritoneal sepsis, and (c) identifying several choices for physical trauma. This paper stresses the relevance of the first aspect, the radiation-induced suppression and recovery of the hemopoietic system.

5477 **(AD-P—003880/2) Infection prophylaxis in large patient populations with combined injury.** Waaij, D.V.D. (University Hospital, Groningen (Netherlands). Lab. for Medical Microbiology). 29 Apr 1983. 15p. NTIS, PC A02/MF A01.

This article is from 'Pathophysiology of Combined Injury and Trauma: Proceedings of the International Symposium (1st) Held at the Uniformed Services University of the Health Sciences, Bethesda, Maryland on 27-29 April 1983,' AD-A144 370, p349-363.

Data are presented relevant to the question of whether medical first aid is possible following a nuclear attack. At a distance from a nuclear explosion at which gamma or neutron radiation is at or above the dose level that causes severe bone marrow damage so that death due to thrombo-cytopenia is inevitable, long-term survival will not be possible without advanced medical care. Because medical aid provided by medical doctors will be virtually nonexisting, discussion is realistic only for measures of enhancement of longterm survival among A-bomb victims who were not lethally ir-

radiated, either because they were (partially) shielded and/or were at a greater distance from the hypocenter. The most realistic conclusions and recommendations regarding first aid can be deduced from what has occurred in reality, i.e., experience in Nagasaki in 1945. It is important that panic be limited. The public should be informed about radiobiology and infection prophylaxis. They should, for example, know that if they find themselves alive after an A-bomb explosion, they have a fair chance to survive the radiation to which they have been exposed.

5478 **(CONF-8409161—2) Neutron and photon fluence-to-dose conversion factors for active marrow of the skeleton.** Kerr, G.D.; Eckerman, K.F. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001250.

From 5. symposium on neutron dosimetry; Munich, F.R. Germany (17 Sep 1984).

Calculation of the absorbed dose to active marrow is a complex problem because charged particle equilibrium may not exist near a soft tissue-bone interface and it is difficult to model the intricate intermixture of soft tissue and bone in the skeleton. This study provides the first definitive calculations for a variety of bones and a wide range of neutron and photon energies. We avoid the assumption of a special geometry by using measured chord-length distributions to represent the microstructure of trabecular bone which contains the active marrow. Results of our calculations for neutrons and photons with energies up to 20 MeV are presented as dose response factors. The response factors can be applied in radiation transport calculations of absorbed dose in active marrow from photons and neutrons externally incident on the body and photons produced by neutrons interactions within the body. 34 references, 6 figures, 2 tables.

5479 **(CONF-8410147—3) Argonne-Utah studies of ^{224}Ra endosteal surface dosimetry.** Schlenker, R.A.; Smith, J.M. (Argonne National Lab., IL (USA); Utah Univ., Salt Lake City (USA). Dept. of Pharmacology). 1984. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002761.

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

The activities of ^{212}Pb relative to ^{224}Ra and of ^{222}Rn relative to ^{226}Ra were measured in bone surface deposits 24 h after radium injection into beagles. The fractional retention of ^{220}Rn atoms was measured in vitro with hydrated and dehydrated bone samples to determine the effect of water content on the escape of radon from bone surfaces. The experimental data suggest that substantial ^{224}Ra daughter product disequilibrium exists in bone surface deposits. Estimates for the lower and upper limits on the fractional retention of ^{220}Rn in vivo are 0.05 and 0.25, respectively. The average bone surface activity of ^{212}Pb relative to ^{224}Ra ranged from 0.34 to 0.71 for four dogs, with the majority of the values toward the low end of the range. Only a small portion of the deposited ^{212}Pb came from lead in the injection solution despite near equilibrium between ^{224}Ra and its daughters at the time of injection. The retention data indicate that the endosteal tissue dose rate in the dogs at one day was actually one-third to about one-half that which would be calculated assuming equilibrium of ^{224}Ra daughter products in bone surface deposits. 11 references, 2 figures, 7 tables.

5480 **(DOE/ER/60142—2) Radiation physics, biophysics and radiation biology. Progress report, December 1, 1983-November 30, 1984.** Rossi, H.H. (Columbia Univ., New York (USA). Radiological Research Lab.). Jul 1984. Contract AC02-83ER60142. 410p. NTIS, PC A18/MF A01; GPO Dep. File Number DE84014885.

Research progress is reported in the areas of radiation physics, biophysics, and radiation biology. Items have been abstracted individually. (ACR)

5481 (FS—83-30-T, pp 45-53) **Technical progress and radiation protection measuring equipment.** Maushart, R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Unjustifiable expense has to be avoided, and the equipment is to be tailored to the purpose of measurements. It is true that those using radiation or handling radioactive substances are faced with quite stringent regulations to afford appropriate radiation protection in practice, and there can be no doubt that equipment and techniques have to keep abreast with technical progress in order to comply with the requirements set by radiation protection provisions, but all steps taken in this direction must be guided by the principle of proportionality. Modern measuring technology not necessarily only relies on expensive or complex equipment. Many tasks can be fulfilled using simple equipment, and user-friendly handling of equipment should be one of the goals of high priority. Avoiding errors in handling and reading will contribute to effective radiation protection, and new equipment has to be checked also from this point of view, which calls for a good cooperation between the manufacturers and the radiation protection experts.

5482 (FS—83-30-T, pp 77-86) **Current status of and foreseeable developments in local dose rate measurement.** Hohlfeld, K.; Boehm, J.; Jahn, H.; Kirchhoff, K. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

This paper deals with portable local dose meters for personal dose monitoring at the working place, and with installed local dose meters for inplant and off-site radiation monitoring. This latter type mainly consists of stationary, installed radiation measuring systems which are available for photon radiation measurement only. As to portable dosemeters, the measurement of various types of radiation is explained.

5483 (FS—83-30-T, pp 87-104) **Dose measurement in radiation protection.** Piesch, E.; Heinzelmann, M.; Lauterbach, U.; Ritzenhoff, K.H.; Wernli, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

This survey discusses the currently available dosimetric methods under the practical aspects of existing and legally prescribed surveillance programs. Emphasis is placed on the interpretation of the measuring results, a.o. the lower detection limit the measuring uncertainty, the energy and direction dependence of dosimetry, the influence of the body on the dosemeter indication. For the purpose of quality assurance, comparative measurements and control irradiations are planned; harmonization of the measuring procedures is achieved and the accuracy of the measurements assured by standardization, design approval and calibration. In this connection development trends and suggestions to improve the measuring technique and the surveillance programs as well as systems for automatic evaluation of dosemeter indications and the use of microprocessors and desk computers for on-line data evaluation are particularly important.

5484 (FS—83-30-T, pp 133-136) **Practical experience gained with automated TLD systems.** Burgkhardt, B.; Duftschmid, K.E.; Kirchhoff, K.; Regulla, D.F.; Ritzenhoff, K.; Wernli, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

5485 (FS—83-30-T, pp 145-148) **Personnel dosimetry using digital alarm systems.** Domke, F. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5486 (FS—83-30-T, pp 157-160) **Comparative measurements with officially accepted personnel dosemeters.** Boehm, J.; Buchholz, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5487 (FS—83-30-T, pp 161-164) **Statistical results of official personnel dose monitoring programmes, 1981.** David, J.; Drexler, G.; Eckerl, H.; Haid, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The data are based on measurements on about 55,000 persons occupationally exposed to radiation in about 6,000 industrial facilities in Bavaria, Hesse, and Schleswig-Holstein. The occupational radiation exposure is described in terms of collective dose, mean annual dose, and frequency distribution of annual doses. These parameters can be calculated on the basis of the personal data stored at the place of work, separately for males and females and for medical and non-medical occupations. The personnel files can also help to identify members of certain occupational groups and thus to get a job-specific picture of occupational radiation exposure.

5488 (FS—83-30-T, pp 189-192) **Recent findings on neutron detection by means of nuclear films.** David, J.; Hoefert, M.; Ritzenhoff, K.H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Nuclear films can be used for neutron-detection in personnel dosimetry above 1 MeV if the fading characteristics are improved by additional drying and sealing in an aluminium capsule. A TV microscope is recommended for counting; this method also permits fast inspection of zero-dose films, which are quite common in routine dosimetry. Interpretation of the relative number of tracks can be based on the normal spectrum available at a nuclear facility. At doses near critical values, however, an accurate analysis of the conditions of irradiation will be necessary.

5489 (FS—83-30-T, pp 193-196) **Neutron detection by means of non-photographic nuclear track detectors.** Piesch, E.; Hassib, G.M. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The dosimetric characteristics of various nuclear track detectors are reviewed. CR 39 detectors were unsatisfactory with regard to energy dependence, foil quality, and reproducibility. Further, there were production-dependent differences in quality within a single batch (background tracks, differences in detector thickness). The relative standard deviation is presented as a function of nuclear track density for Makrofol and CR 39 detectors. In Cr 39 detectors, empirical correction of the response characteristics in dependence of the detector thickness will considerably improve the reproducibility. Detectors with (n, α) converters can replace TL detectors, especially in neutron detection in fields with relatively strong γ radiation. In personnel monitoring, on the other hand, recoil detectors may be useful to supplement albedo neutron dosemeters.

5490 (FS—83-30-T, pp 197-200) **Is it possible to use CR39 detectors as personnel dosemeters for fast neutron radiation.** Schraube, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Criteria are listed which govern the applicability of CR 39 dosemeters as local or personnel dosemeters in general and in measurements of the angle of incidence (i.e. for correction of the angular dependence of the detection efficiency).

5491 (FS—83-30-T, pp 201-204) **Albedo neutron dosemeter for personnel monitoring.** Piesch, E.; Burgkhardt, B. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5492 (FS—83-30-T, pp 275-276) **Contamination monitoring using a microprocessor-controlled personnel contamination monitor.** Gerlach, R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5493 (FS—83-30-T, pp 391-394) **Organically bonded tritium in plants.** Strack, S.; Koenig, L.A. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

In almost all samples, the ratio found between organically bonded tritium (OGT) and tritiated water in the biosphere (HTO) was $R = OGT/HTO > 1$. Such R values of the samples taken in the environment of Karlsruhe Nuclear Research Centre cannot be explained by a balanced model of the behaviour of tritium in plants. This is why the dynamic behaviour of T is currently systematically studied in a tree standing on the premises of the nuclear research centre. The OGT values of the leaves in the vegetation period of 1981 rose from 1.4 +- 0.22 pCi/ml of oxidation water in the buds to 4.6 +- 0.35 pCi/ml during the leaf-shedding period. The largest ratio found was $R = 8.2$.

5494 (FS—83-30-T, pp 403-406) **Indoor and outdoor radon exposure and the assessment of resulting lung dose to the population.** Keller, G.; Folkerts, K.H.; Dudler, R.; Muth, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The indoor and outdoor activity concentrations of Rn-222, its short-lived decay products, as well as the concentrations of the thoron decay products Pb-212/Bi-212 have been measured in the Saarland and the Rhineland-Palatinate. The mean indoor concentration of Rn has been measured to be 26 $Bqxm^{-3}$ and is three to four times higher than measured outdoor concentrations. The potential α-energy concentration of the Rn-222 decay products has been 1.7 mWL in dwellings, and 0.9 mWL for those of Rn-220 decay products, the equilibrium factor in dwellings being 0.3. Dependence of concentrations on the structural materials used is low as compared with the gamma dose rate, whereas ventilation of rooms plays an important part. The mean lung dose to the population has been computed to be 2.3 due to inhalation of Rn-222 and Rn-220 decay products, with the dose to be attributed to Rn-220 decay products amounting to 30% of the dose resulting from Rn-220 decay products. A risk assessment for the population of the FRG shows a

mean lifetime probability of the development of lung carcinoma due to inhalation of short-lived Rn-222 and Rn-220 decay products of about $6x10^{-4}$.

5495 (FS—83-30-T, pp 421-430) **Incorporation monitoring by means of direct measurement of body activity levels in a nuclear facility.** Doerfel, H.R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Methods of measurement and measuring instruments (whole-body counters, lung counters, thyroid counters used at Karlsruhe Nuclear Research Center for incorporation monitoring when working with unsealed radiation sources (fission and activation products, actinides) are presented.

5496 (FS—83-30-T, pp 443-452) **Incorporation monitoring by excretion analyses.** Beyer, D.; Dilger, H.; Schieferdecker, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

According to section 3.2 of the guideline on physical radiation protection, the measuring methods shall guarantee 'that an incorporation at the beginning of the surveillance period that amounted to more than 1/20 of the maximum annual intake as defined in section 52, sub-section (1), no. 1 of the Radiation Protection Ordinance is to be recognized as such also at the end of the surveillance period'. Incorporation surveillance can be done either at regular intervals, or as a special measure whenever the occasion arises. Taking into account the metabolic pathway models of the individual nuclides, the excretion rates to be expected with the various nuclides are calculated and are compared with the detection limits of the measuring methods applied. It is shown that especially when short-lived nuclides are involved, or radiochemically highly toxic nuclides such as Pu-239, the requirements set by the guideline cannot always be met, unless steps will be taken to improve the detection limit by progress made in terms of measuring technique and analytics. Another way out of the dilemma would be to alter the procedure of incorporation monitoring, for instance by surveillance of reference persons instead of the collective, thus reducing the monitoring period. This will bring about a clear reduction of the factor of conservative assumption when extrapolating the measured data to the time probable intake.

5497 (FS—83-30-T, pp 453-455) **Rapid, pre-selective measurement for incorporation monitoring using a simple measuring kit.** Kirsch, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The incorporation monitor H 1398 is an integrally measuring partial body monitor (for lung, thyroid), with two large-surface NaJ(Tl) detectors. Within a measuring period of 10 s, a detection sensitivity of $<= 50$ nCi for Co-60 is guaranteed; this corresponds to about 0.2% of the admissible annual uptake of radioactivity. The monitor is commercially available as a device to sit on, or to lean against.

5498 (FS—83-30-T, pp 457-461) **Calculation of probable dose from measured incorporation data.** Auf der Maur, A.; Lauffenburger, T. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

In case of more or less continuous intake of radioactive substances, or in case of radioactivity uptake at an unknown date, incorporation measurements take the characteristic feature of a random test. When surveying the intake of 7-125, for example, by thyroid measuring every 3 months, or of H-3 by excretion measurements, the ratio between measuring interval and effective half-life is 2.3, or 3 respectively, so that the interpretation of measured results may be considerably influenced by a range of error sources. With a view to nuclides with exponential biological half-life, the following questions are put in order to find a solution: (1) How should the measured data be converted to data indicating the dose or radioactivity received from a radionuclide. Which data are of interest, the probable dose, or the possible maximum value. (2) How can a variation of measured data be taken as a basis to derive information on the difference between the calculated probable dose and the true uptake or dose. The conclusions drawn by the authors are the following: (1) Calculation of probable dose is a source of information also in case of incorporation at an unknown date. (2) Measured data can be taken as a means to get an idea of the accurateness of this interpretation.

5499 (FS—83-30-T, pp 463-466) **Incorporation monitoring and body dose. Comparison of cumulative radioactivity data calculated from biokinetic data according to the prescribed method, or according to ICRP publication 30.** Buheitel, G.; Roedler, H.D. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

For the radionuclides given in Annex 4 of the official method to calculate radiation doses to body tissues, the quality of the approximations used is verified. The relationship between the cumulative activity data obtained using the retention function of the official calculation method and the cumulative activity data derived according to ICRP publication 30 serves as the criterion of the verification. A table is given showing the relationship of cumulative activity data for all those cases where different results are obtained. The data shown are based on measurements carried out 1 day or 1, 3, or 6 months after incorporation. The data of special relevance with a view to the recommended surveying intervals are indicated. For the 22 radionuclides investigated by this comparison, full agreement in 55%, and agreement within a factor of 2 is found. Only with uranium and Au-198 larger deviations are observed. Thus the cumulative activity data calculated on the basis of the half-lives given in the official method to calculate radiation doses to body tissues and the data obtained on the basis of ICRP publication 30 agree within a factor of 2, except for 6 radionuclides.

5500 (FS—83-30-T, pp 467-470) **Microprocessor-controlled stabilisation of the calibration and peak of a human body counter.** Heinrich, M.; Boetticher, H. von. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

To simplify routine gain adjustment of the detectors, and in order to achieve good long-term stability, a digital method of gain adjustment applying high-voltage control has been developed. The required control and computer functions are carried out by a microcomputer system, TM 990/189. Calibration proceeds in two steps: After starting the program by entering the energy of the calibration peak, all 16 photomultiplier signals are separately adjusted to a uniform mean pulse height. Fine adjustment of the four detector summation signals is achieved by re-adjusting the respective four photomultiplier signals. The process is constantly repeated during the operating pauses, thus guaranteeing a reliably good stability of the energy calibration of the measured spectra.

5501 (FS—83-30-T, pp 471-474) **Simple method to assess the radioactivity of short-lived isotopes in the human body.** Goerlich, W.; Wernli, C.; Besancon, A.; Valley, J.F. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Radioactivity measurements on the thyroid are used to explain that efficient incorporation monitoring can be done without additional expense for personnel, measuring units, and more frequent measurements. A simplified method is described allowing early detection of radioactivity levels exceeding permissible levels at the working site, as e.g. a laboratory. Using commercially available contamination monitors that are normally used in isotope-handing laboratories, any person likely to receive a hazardous dose can check incorporation on its own after working hours. Various commercially available monitors for thyroid measurements are investigated for their sensitivity and reliability in measuring the radioactivity from I-123, I-125, I-131, and Tc-99m.

5502 (FS—83-30-T, pp 521-528) **Non-ionizing radiation.** Fischer, P.G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The still growing use of non-ionizing radiation such as ultraviolet radiation laser light, ultrasound and infrasound, has induced growing interest in the effects of these types of radiation on the human organism, and in probable hazards emanating from their application. As there are up to now no generally approved regulations or standards governing the use of non-ionizing radiation and the prevention of damage, it is up to the manufacturers of the relevant equipment to provide for safety in the use of their apparatus. This situation has led to a feeling of incertainty among manufacturers, as to how which kind of damage should be avoided. Practice has shown that there is a demand for guidelines stating limiting values, for measuring techniques clearly indicating safety thresholds, and for safety rules providing for safe handling. The task group 'Non-ionizing radiation' of the Radiation Protection Association started a programme to fulfill this task. Experts interested in this work have been invited to exchange their knowledge and experience in this field, and a collection of loose leaves will soon be published giving information and recommendations.

5503 (FS—83-30-T, pp 529-540) **Principles and methods of calculation to determine body doses from external irradiation.** Drexler, G.; Burger, G.; Piesch, E. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The principles and methods explained by this paper supplement the Physical Radiation Protection Guide (sections 62 and 63 of the Radiation Protection Ordinance) stating the rules for calculating not directly measurable body doses from personnel monitoring data and all other additional information about exposure conditions. A method of corrilating radiation field quantities with the body doses of relevance for radiation protection is explained by calculation models for gamma, electron, and neutron radiation, giving the conversion functions for local or personal doses and body doses.

5504 (FS—83-30-T, pp 545-548) **Ultraviolet radiation, measurements and safety evaluations for radiation protection purposes.** Witew, B.; Fischer, P.G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

In order to evaluate the effects of ultraviolet radiation, one has to study that photobiologically effective radiation which induces a just measurable threshold reaction. For practical radiation protection, one has to determine the permissible duration of exposure at the end of which the threshold reaction is induced. This time limit is derived by means of spectral measurements and determination of radiation intensity. Detrimental photobiological effects can be avoided, and favourable effects optimized, by observing the time limit. Thus these measurements are used to determine the threshold at which the desired effects of ultraviolet radiation will be accompanied by unwanted effects or damage to persons, as for instance in the use of ultraviolet radiation for operating room sterilization, arc welding work, or cosmetic purposes.

5505 (FS—83-30-T, pp 549-552) **Determination of partial body dose and whole-body dose using personal dosemeter systems.** Siebert, B.; Hollnagel, R.; Jahr, R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

With 'adjusted' dosemeter systems, the true dose can be measured without knowing the real fluence distribution. With 'non-adjusted' systems, this is only possible with some information on the fluence distribution. In this case, multidetector systems (with R detectors) are of advantage, as the superposition may than contain many different terms of the fluence distribution. In the most general case of 'non-adjusted' systems and unknown fluence distributions only optimized error limits can be given. Apart from the assumed fluence distribution proportionality and 'additivity' of partial doses, which is always given due to the corresponding properties of the energy deposition, an analogous fluence distribution proportionality and additivity of detector indications is assumed which is applicable for many detectors, but not for all. One exception for instance is the film blackening due to photon exposure.

5506 (FS—83-30-T, pp 553-556) **Induction of chromosomal aberrations in human lymphocytes as a biological dosemeter of X-ray, γ, and β radiation.** Brandenburg, K.; Seydel, U.; Lindner, B.; Luethje, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

The induction of chromosomal aberrations in in-vitro cultures of human lymphocytes by different β emitters was compared with the induction rate of electromagnetic radiation (X-ray and γ radiation). The dose rate dependence was determined by chronic irradiation (over the whole incubation period) and acute irradiation (up to 2 h before lymphocyte stimulation). The measured dose-effect relationships are discussed with a view to their suitability for biological dosimetry, and some interpretations of the mechanism of action are presented.

5507 (FS—83-30-T, pp 565-568) **Biochemical indicators of radiation exposure.** Boegl, W.; Stamm, A.; Heide, L.; Reich, E.; Stumpf, E.; Willich, N.; Lissner, J. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

In an extensive bibliographic study, suitable techniques of dose determination by means of biochemical indicators were established. Three of these methods are now tested on radiotherapy patients: (a) radiation-induced increase of the serum thymidine level; (b) potentially radiation-induced changes in the serum activity of isoenzymes of acid phosphatase; (c) radiation-induced changes in the activity of serum amylase.

5508 (FS—83-30-T, pp 569-578) **Cytometric approaches to biological dosimetry.** Burger, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Munich, F.R. Germany (19 Oct 1982).

Automatic cytometric techniques for detecting chromosomal aberrations are being tested but will not be used in routine examinations for some time to come. Automatic micronuclei counts are more promising but not sufficiently sensitive in the low dose range ($<=0.05$ Sv). Other studies focus on lymphocytes and other test

cell systems (measurements of morphological changes in nuclear chromatine) or on morphological changes in sperms. Measurements in blood and sperm are favoured because of the easiness of obtaining samples. Automatic techniques will, in principle, have higher sensitivity, so that biological dosimetry will no longer be applied in accident dosimetry alone but also for screening of groups occupationally exposed to doses below the maximum permissible annual dose.

5509 **(IAEA-R—2740-F) Methods of assessment of individual and collective doses to transport workers and members of the public during the transport of radioactive materials. Part of a coordinated programme on safe transport of radioactive material. Final report for the period 1 December 1980 - 31 May 1983.** Vohra, K.G. (International Atomic Energy Agency, Vienna (Austria)). Dec 1983. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703260.

A study in India, partially supported by an IAEA research contract, provided measurements of exposure to transport workers associated with the transport of radioisotopes for medical, industry and research purposes. A survey showed this to be the single most significant source of transport worker exposure in India. The largest exposures were found with transport workers at the Bombay airport through which these packages are "funnelled". The maximum occupational doses were found to be between 1.8 and 2.0 mSv/y assuming only four men handle all of the packages throughout the year. Furthermore, it was found that the surface transport of these materials in the Bombay area results in an estimated maximum annual collective dose to the public of only 0.1 man Sv/y. It was further noted that this collective dose results not from high radiation levels but from the high population density involved in the Bombay aren. The model provides reasonable correlation with the measured data, but it was indicated that additional testing of the model needed to be performed. The data indicate a correlation between persons preparing the packages and persons handling the packages in transport. It was not possible to derive a simple empirical model based solely on Transport Index.

5510 (Juel-Spez—255, pp 156) **Skin dose of the contaminations at JULIC.** Probst, H.J.; Uray, I. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

5511 **(NIRS—19) Annual report of Laboratory of Institute of Radiological Sciences of the fiscal year 1979.** (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1980. 121p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703315.

This annual report covers the period from April 1, 1979, to March 31, 1980, and the information on the research carried out by the staffs of the institute during this period is given. The total budget for the fiscal year 1979 was more than 3,368 million yen including personnel costs. Besides basic research, three long term projects have been carried on. The research on the medical application of a cyclotron that had been started in April, 1976, was completed at the end of March, 1979, and on the basis of the result of this project, the new research on the medical application of a particle accelerator was started in April, 1979, which will continue for five years.Tm Two other projects, i.e. the risk assessment on the delayed effect of radiation and the research on the exposure to environmental radiation caused by nuclear facilities and others have progressed satisfactorily. In the report, the summaries of 16 papers on physical studies, 6 papers on chemistry, 10 papers on biochemistry and biophysics, 5 papers on cytology and morphology, 21 papers on physiology, 9 papers on genetics, 15 papers on medical studies and 15 papers on environmental studies are collected.

5512 **(NIRS—20) Annual report of National Institute of Radiological Sciences of the fiscal year 1980.** (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1981. 105p. NTIS (US Sales Only), PC A06/MF A01. File Number DE84703316.

This report covers the period from April 1, 1980, to March 31, 1981, and the information on the research carried out by the staffs of the institute during this period is given. The total budget for the fiscal year 1980 was about 4,475 million yen including personnel costs. Besides basic research, three long term projects have been carried on, i.e. the risk assessment on low level radiation, the research on the exposure to environmental radiation caused by nuclear facilities and others and the medical application of a particle accelerator. In connection with the project on the risk assessment of low level radiation, a new laboratory for the research on internal radiation effect has been constructed since 1979, and is expected to be completed in the fiscal year 1983. These three projects have progressed satisfactorily. In this report, the summaries of 14 papers on physics, 7 papers on chemistry, 12 papers on biochemistry and biophysics, 8 papers on cytology and morphology, 8 papers on physiology, 7 papers on genetics, 5 papers on immunology and hematology, 9 papers on medical studies and 22 papers on environmental studies are collected.

5513 **(NIRS—21) Annual report of National Institute of Radiological Sciences of the fiscal year 1981.** (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1982. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE84703317.

This report covers the period from April 1, 1981, to March 31, 1982, and the information on the research carried out by the staffs of the institute during this period is given. The total budget for the fiscal year 1981 was 5,038.9 million yen including personnel costs. Besides basic research, three long term projects have been carried on, i.e. the risk assessment on low level radiation, the research on the exposure to environmental radiation caused by nuclear facilities and others and the medical application of a particle accelerator. In connection with the project on the risk assessment of low level radiation, a new laboratory for the research on internal radiation effect has been under construction, and is expected to be completed in the fiscal year 1983. The biological effect of tritium has been adopted as a subtheme of this project. These three projects have progressed satisfactorily. In the report, the summaries of 10 papers on physics, 5 papers on chemistry, 9 papers on biochemistry and biophysics, 13 papers on cytology and morphology, 10 papers on physiology, 9 papers on genetics, 8 papers on immunology and hematology, 8 papers on medical studies and 17 papers on environmental studies are collected.

5514 **(NIRS-AR—24) Annual report of National Institute of Radiological Sciences of the fiscal year 1981.** (National Inst. of Radiological Sciences, Chiba (Japan)). Oct 1982. 186p. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number DE84703314.

This institute was established in 1957, and has engaged in the research on the injuries of human bodies by radiation and the medical utilization of radiation, and in the training of engineers for this field. Recently, the peaceful use of atomic energy has advanced, and the research on the safety of environmental radiation has become important. Also the social concern to the medical utilization of radiation has heightened. The works carried out in fiscal 1981 were as follows. As the special research which is carried out on large scale utilizing the all-roundness of the institute, the research on the estimation of the danger of low level radiation to human bodies, the investigation of the exposure to environmental radiation due to nuclear facilities, and the research on the medical utilization of particle accelerators were performed. As the designated research to be promoted urgently, the reevaluation aoof radiation dose in the atomic bombing of Hiroshima and Nagasaki, the research on the refining of cell growth genes and their action, the research on the radiation effect to the in vitro culture system of the initial embryos of mammals, and the examination of the various factors modifying the natural killer cell activity of man were carried out. The summaries of these researches as well as those of ordinary researches are reported.

5515 **(PB—84-236249) Evaluation of the European Community's radiation protection research programme (1976-1980). Research evaluation report No. 8.** Sinclair, W.K.; Akehurst, R.L.; Bresson, G.; Oberhausen, E.; Oftedal, P. (Commission of the European Communities, Luxembourg). 1983. 57p. (EUR—8648-EN). NTIS, PC E04/MF E04.

The task of conducting a critical review of the radiation protection research and development programme 1976-80, was entrusted to a panel of seven external independent experts appointed by the Commission. The panel focussed on the assessment of the scientific and technical achievements during the period 1976-80, the evaluation of the effectiveness of the programme management and of the utilization of the resources as well as the assessment of the socio-economic impact of the programme and the elaboration of recommendations for future orientation of research. The report summarizes the discussions and conclusions of the evaluation panel.

5516 **(PNL-SA—11785) Life-span radiation effects studies in animals: what can they tell us.** Thompson, R.C. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 6p. (CONF-840512—19). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003111.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

Results from life-span studies in a variety of animal species have found relatively little application in the development of radiation risk factors for various organs of man. This paper discusses possible reasons for this situation and presents recommendations to correct it. (ACR)

5517 **(PNL-SA—12466) Hanford study: a review of its limitations and controversial conclusions.** Gilbert, E.S. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 15p. (CONF-841077—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002536.

From Statistics symposium on national energy issues; Seattle, WA, USA (16 Oct 1984).

The Hanford data set has attracted attention primarily because of analyses conducted by Mancuso, Stewart, and Kneale (MSK). These investigators claim that the Hanford data provide evidence that our current estimates of cancer mortality resulting from radiation exposure are too low, and advocate replacing estimates based on populations exposed at relatively high doses (such as the Japanese atom bomb survivors) with estimates based on the Hanford data. In this paper, it is shown that the only evidence of association of radiation exposure and mortality provided by the Hanford data is a small excess of multiple myeloma, and that this data set is not adequate for reliable risk estimation. It is demonstrated that confidence limits for risk estimates are very wide, and that the data are not adequate to differentiate among models. The more recent MSK analyses, which claim to provide adequate models and risk estimates, are critiqued. 18 references, 1 table.

5518 **(RERF-TR—6-81) Life span study report 9, part 3. Tumor registry data, Nagasaki 1959-78.** Wakabayashi, Toshiro; Kato, Hiroo; Ikeda, Takayoshi; Schull, W.J. (Radiation Effects Research Foundation, Hiroshima (Japan)). Apr 1983. 31p. (In Japanese, English). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703255.

The incidence of malignant tumors in the RERF Life Span Study (LSS) sample in Nagasaki as revealed by the Nagasaki Tumor Registry (Registry) has been investigated for the period 1959-78. No exposure status bias in data collection has been revealed. Neither method of diagnosis, reporting hospitals, nor the frequency of doubtful cases differ by exposure dose. Thus, the effect of a bias, if one exists, must be small and should not affect the interpretation of the results obtained in the present analysis. The risk of radiogenic cancer definitely increases with radiation dose for leukemia, cancer of the breast, lung, stomach, and thyroid, and suggestively so for cancer of the colon and urinary tract and multiple myeloma. However, there is no increase as yet for cancer of the esophagus, liver, gall bladder, uterus, ovary, and salivary gland, or for malignant lymphoma. For fatal cancers, these results strengthen those of the recent analysis of mortality based on death certificates on the same LSS cohort. In general, the relative risks based on incidence (that is, on Registry data) are either the same or slightly higher than those based on mortality for the same years; however, the absolute risk estimates (excess cancer per million person-year per rad) are far higher.

5519 **(RERF-TR—18-81) Relationship of stature to gamma and neutron exposure among atomic bomb survivors aged less than 10 at the time of the bomb, Hiroshima and Nagasaki.** Ishimaru, Toranosuke; Amano, Takako; Kawamoto, Sadahisa. (Radiation Effects Research Foundation, Hiroshima (Japan)). Oct 1982. 9p. (In Japanese, English). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703254.

A reanalysis has been undertaken of the relationship of attained adult height of Hiroshima and Nagasaki atomic bomb survivors aged less than 10 at the time of the bomb (ATB) to radiation dose based upon new dosimetry data. The present analysis aims to examine the relationship of stature to radiation dose in terms of gamma rays and neutrons, separately. The 628 individuals were selected from Hiroshima and Nagasaki survivors, aged less than 10 ATB, whose doses were available, and whose statures were recorded at the Adult Health Study (AHS) biennial health examination during 1970-72. To ascertain the relationship of attained adult stature to gamma and neutron doses three dose response models were applied to the data. The analysis revealed that the attained height is a separate function of exposure to gamma rays and neutrons. The model assuming a squared term dependence on gamma rays and a linear dependence on neutrons provides a better explanation of the data. The regression coefficient associated with the squared gamma dose is -0.00000927 and the coefficient associated with neutron dose is -0.0172. The relative biological effectiveness of neutrons in relation to gamma radiation with respect to the effect for diminished development of stature is estimated as $43.1 / \sqrt{Dn}$ in kerma (Dn=neutron dose). The 95% confidence limits are $19.3 / \sqrt{Dn}$–$96.5 / \sqrt{Dn}$.

5520 **(RERF-TR—26-81) Survey of dental radiology among RERF, Hiroshima and Nagasaki populations.** Kihara, Takuji; Sawada, Shozo; Antoku, Shigetoshi; Takeshita, Kenji; Russell, W.J.; Otake, Masanori; Yoshinaga, Haruma; Beach, D.R. (Radiation Effects Research Foundation, Hiroshima (Japan)). Mar 1983. 30p. (In Japanese, English). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703262.

Dental hospitals and clinics in Hiroshima and Nagasaki cities were surveyed to assess the frequency and type of dental radiography performed during 2-week periods from March through June 1976. Patients radiographed were categorized as members of the Adult Health Study (AHS), non-AHS (Extended Life Span Study other than AHS) sample and general populations, and also categorized as Atomic Bomb Survivors Health Handbook holders (the A-bomb exposed) and nonholders of the handbook (the nonexposed). All of these groups were variously compared. They were mainly exposed to conventional oral radiography, and to a much lesser extent(3%-5%) to orthopantomography. The exposure frequencies for oral radiography per caput per year in Hiroshima were 1.2 for AHS, 0.9 for non-AHS, and 0.9 for the general population. In Nagasaki, these were 0.9, 1.1, and 0.6, respectively. The oral radiography exposure rates for the A-bomb exposed were 0.6 in Hiroshima and 0.5 in Nagasaki. For the nonexposed, these were 1.0 and 0.8, respectively. Thus, the exposure rates were about 1.5 times greater among the nonexposed than the exposed in both cities. The analysis of technical factors used revealed that, compared to a previous survey (1970), many dental radiographic machines were fitted with open-end cylindrical cones. Because of this a reduction in exposure dose can be inferred. Data obtained in the present investigation are essential for subsequent estimations of exposure doses of the populations of Hiroshima and Nagasaki cities.

5521 **(SAAS—312) 1982 UNSCEAR Report on the assessment of human exposure levels.** Doerschel, B. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85780205.

A brief summary of the 1982 UNSCEAR Report (excepting the chapter on New Developments in Radiobiology) is followed by some conclusions as to further tasks in the field of radiation protection.

5522 **(UCRL—53524) Frequencies of chromosomal aberrations and sister chromatid exchanges in the benthic worm Neanthes arenaceodentata exposed to ionizing radiation.** Harrison, F.L.; Rice, D.W. Jr., Moore, D.H. (Lawrence Livermore National Lab., CA (USA)). Jul 1984. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85003159.

Traditional bioassays are unsuitable for assessing sublethal effects from ocean disposal of low-level radioactive waste because mortality and phenotypic responses are not anticipated. We compared the usefulness of chromosomal aberration and sister chromatid exchange (SCE) induction as measures of low-level radiation effects in a sediment-dwelling marine worm, Neanthes arenaceodentata. The SCEs, in contrast to chromosomal aberrations, do not alter the overall chromosome morphology and in mammalian cells appear to be a more sensitive indicator of DNA alterations caused by environmental mutagens. Newly hatched larvae were exposed to two radiation-exposure regimes of either x rays at a high dose rate of 0.7 Gy (70 rad)/min for as long as 5.5 min or to ^{60}Co gamma rays at a low dose rate of from 4.8×10^{-5} to 1.2×10^{-1} Gy (0.0048 to 12 rad)/h for 24 h. After irradiation, the larvae were exposed to 3×10^{-5}M bromodeoxyuridine (BrdUrd) for 28 h (x-ray-irradiated larvae) or for 54 h (^{60}Co-irradiated larvae). Larval cells were examined for the proportion of cells in first, second, and third or greater division. Frequencies of chromosomal aberrations and SCEs were determined in first and second division cells, respectively. Results from x-ray irradiation indicated that dose-related increases occur in chromosome and chromatid deletions, but a dose of equal or greater 2 Gy (equal to or greater than 200 rad) was required to observe a significant increase. Worm larvae receiving ^{60}Co irradiation showed elevated SCE frequencies with a significant increase of 0.6 Gy (60 rad). We suggest that both SCEs and chromosomal aberrations may be useful for measuring effects on genetic material induced by radiation. 56 references, 7 figures, 9 tables.

5523 (ZfI-Mitt—77, pp 37) **Detoxication function of the liver characterized by means of [^{13}C, ^{15}N]methacetin.** Krumbiegel, P.; Hirschberg, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Guenther, K. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Radiologische Klinik). Sep 1983. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number TI85780083. (CONF-8305218—Summ.).

From Recent results of /sup 15/N tracer technique in medicine symposium; Rostock, German D.R. (29 May 1983).

Published in summary form only.

5524 (ZfI-Mitt—80, pp 117-118) **Isotope effects in urea clearance.** Hirschberg, K.; Faust, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5525 **Restriction enzyme cleavage of ultraviolet-damaged simian virus 40 and pBR322 DNA.** Cleaver, J.E. (Univ. of California, San Francisco). *Journal of Molecular Biology;* **170**: 305-317(1983).

Cleavage of specific DNA sequences by the restriction enzymes EcoRI, HindIII and TaqI was prevented when the DNA was irradiated with ultraviolet light. Most of the effects were attributed to cyclobutane pyrimidine dimers in the recognition sequences; the effectiveness of irradiation was directly proportional to the number of potential dimer sites in the DNA. Combining ECoRI with dimer-specific endonuclease digestion revealed that pyrimidine dimers blocked cleavage within one base-pair on the strand opposite to the dimer but did not block cleavage three to four base-pairs away on the same strand. These are the probable limits for the range of influence of pyrimidine dimers along the DNA, at least for this enzyme. The effect of irradiation on cleavage by TaqI seemed far greater than expected for the cyclobutane dimer yield, possibly because of effects from photoproducts flanking the tetranucleotide recognition sequence and the effect of non-cyclobutane (6-4)pyrimidine photoproducts involving adjacent T and C bases.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 5603004210, 4267, 4268, 4323, 4876, 5299, 5307, 5390, 5391, 5434

5526 **(AD-A—144759/8) Fate and distribution of 3H-labeled T-2 mycotoxin in guinea pigs. Interim report.** Pace, J.G.; Watts, M.R.; Burrows, E.P.; Dinterman, R.E.; Matson, C. (Army Medical Research Inst. of Infectious Diseases, Frederick, MD (USA)). 3 Aug 1984. 30p. NTIS, PC A03/MF A01.

T-2 toxin is a potent cytotoxic metabolite produced by the Fusarium species. The fate and distribution of (3H)-labeled T-2 toxin were examined in male guinea pigs. Radioactivity was detected in all body tissues within 30 min after an im intection of an LD(50) dose (1.04 mg/kg) of T-2 toxin. The plasma concentration curve of radioactivity versus time was multiphasic, with an initial absorption half-life (T1/2,E) of less than 6 min. The initial half-life of elimination (T1/2,A) was 1.8 hr. Bile contained a large amount of radioactivity which was identified as HT-2,4-deacetylneosolaniol, 3'hydroxy HT-2, 3'hydroxy T-2 triol, and several more-polar unknowns. These T-2 metabolites are excreted from liver via bile into the intestine. Within 5 days, 75% of the total radioactivity was excreted in urine and feces at a ratio of 4 to 1. The appearance of radioactivity in the excreta was biphasic (T1/2,A=2.2 hr, 1.5 days and 8.2 hr, 1.7 days, for urine and feces, respectively). Metabolic derivatives of T-2 excreted in urine were T-2 tetraol, 4-deacetylneosolaniol, 3' hydroxy HT-2, and several unknowns. These studies showed a rapid appearance in and subsequent loss of radioactivity from tissues and body fluids. However, radioactivity (ten to the fifth power dpm) was still detectable in tissues at 28 days. The distribution patterns and excretion rates suggest that liver and kidney are the principal organs of detoxication and excretion of T-2 toxin and its metabolites.

5527 **(AD-A—145010/5) Immunochemistry of rat lung tumorigenesis. Annual report No. 1, November 1980-May 1981.** Guirgis, H.A. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). Oct 1981. 28p. NTIS, PC A03/MF A01.

Changes in cell mediated immunity have been identified in relation to tumorigenesis. Most chemical carcinogens were found to be immunosuppressive. Cytogenetic changes and impaired DNA repair-synthesis were also found to be associated in chemical carcinogenesis. Measurement of temporal variability of immunologic, cytogenetic and DNA repair changes in relation to exposure to chemical carcinogens and throughout initiation and progression of lung cancer in an animal model is the subject of this research project. The first phase of this investigation includes the in vitro measurement of cellular immune response as well as sister chromatid exchange and DNA replication and repair synthesis in spleen, thymus and blood lymphocytes in control rats. This project was initiated in November of 1980; therefore, this annual report reflects only 8 months of work. It is projected that Phase I be concluded by the end of 1981. This will be followed by Phase II which will include the measurement of cellular immune parameters, sister chromatid exchange and DNA replication and repair synthesis in spleen, thymus and blood lymphocytes throughout tumorigenesis in rats intratracheally exposed to 3-methylcholanthrene (MCA).

5528 **(AD-A—145187/1) Thromboxane-mediated injury following radiation. Annual summary report No. 1, January-September 1984.** Rose, J.C. (Georgetown Univ., Washington, DC (USA). Dept. of Physiology and Biophysics). 31 Aug 1984. 51p. NTIS, PC A04/MF A01.

The hypothesis under investigation is that moderate levels of radiation exposure result in endothelial and other tissue damage which, in turn, increases in vivo synthesis of thromboxane A2 (TXA2) and/or decreases synthesis of prostacyclin (PGI2). It is proposed that this altered arachidonate metabolism results in vasoconstriction and decreased peripheral blood flow, thereby leading to further tissue damage which is proportional to the degree of ra-

diation exposure. The observations described in this first annual report demonstrate that whole body gamma irradiation results in a indomethacin sensitive increase in urine TXB2 four to 120 hours after 10 Gy and four to 12 hours after 20 Gy whole body irradiation. Exposure to 20 Gy also increased in vivo synthesis of the PGI2 hydrolysis product, 6-keto PGFla. These studies also showed that radiation-induced increases in TXB2 are due to altered extrarenal synthesis, while the altered 6-keto PGFla levels appear to be due to changes in intrarenal arachidonate metabolism. The projected studies for the second year will include identification of the organs and tissues involved in radiation-induced alterations in urine cyclooxygenase product synthesis using regional shielding techniques.

5529 (BNL—51542, pp 11) **Wood combustion.** Morris, S.C. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

Wood is generally considered a clean fuel, but its combustion emits particles, polycyclic organic matter (POM), carbon monoxide, and possibly nitrogen oxides at higher rates per unit energy than does that of oil. As a simplifying approach for a first estimate of health effects, benzo(a)pyrene (BaP) was used as an index of POM. This is a commonly used index but suffers from the problem that BaP to total POM ratios differ among effluents from various sources. The health effects associated with these pollutants are discussed.

5530 (BNL—51542, pp 12-17) **Polycyclic organic matter.** Morris, S.C. (Brookhaven National Lab., Upton, NY). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

Coal combustion products contain a number of polynuclear aromatic hydrocarbons including polycyclic organic matter (POM) which have been proven to be mutagenic in bacterial tests and carcinogenic in animals, including man. A synergistic effect between benz(a)pyrene POM and SO_2 has been demonstrated in animals, and the presence of such irritants as SO_3 may explain the higher carcinogenic activity of POM in some occupational studies. Some estimates have been made of health damage using general population studies, but better epidemiological results are available from occupational studies. The relative contributions of POM from different sources are considered, and the emission concentrations are presented. The use of models are discussed in relation to predicting the effects of chemical carcinogens.

5531 (BNL—51542, pp 26-36) **Potential health impacts of light duty diesel vehicles.** Cuddihy, R.G. (Inhalation Toxicology Research Inst., Albuquerque, NM). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The potential health impacts of increased use of light duty diesel vehicles are described with emphasis on recent scientific developments. The potential health impacts are presented in two categories; risks to workers in diesel-related industries and risks to the general public. Emissions were evaluated in two categories; vapor and gaseous emissions and particle emissions. The vapor and gaseous emissions included oxides of nitrogen, sulfur and carbon, and organic compounds classified as alkanes, alkenes or aldehydes.

5532 (BNL—51542, pp 37-76) **Potential health and environmental effects of the fluidized bed combustion of coal: a preliminary assessment.** Seiler, F.A.; Hobbs, C.H. (Inhalation Toxicology Research Inst., Albuquerque, NM). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The increased use of coal to meet the nation's energy needs has focused attention on various methods of coal conversion and combustion, and considerable efforts have been made to develop viable large-scale technologies such as the fluidized bed combustion of coal. Because coal consumption may double before the end of the century, the health effects in the general population are a major concern. This risk assessment effort is directed at identifying areas of potential health and safety risks from the fluidized bed combustion of coal to workers in the industry and to the general public, before the technology is deployed. In this status report, the results to date of a first evaluation of the problem are presented. Error propagation in risk assessment and atmospheric dispersion models in risk assessments of entire technologies are discussed in detail in the appendices.

5533 (BNL—51542, pp 77-94) **Potential health effects of airborne combustion products from oil shale.** Gratt, L.B. (IGW Corp., San Diego, CA). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

An overview is presented of the oil shale fuel cycle which consists of two main segments: retorting and end use. The potential health effects of the combustion products are discussed with emphasis on the health effects of end use. The human population in the oil shale region may be exposed to air pollutants which include polycyclic aromatic hydrocarbons and nitrogen-containing aza-azarines. The health effects of each of the pollutants are presented independently. An approach based on using sulfur oxides as a surrogate for all air pollutants is also used. Analysis of the potential health effects from airborne pollutants indicates all exposures are below the threshold levels except for hydrogen sulfide, sulfur oxides, and particulates. The health effects of gasoline stocks, jet fuel, Diesel Fuel Marine, and residual fuels are summarized. Future research needs for the problem of emissions of shale oil-derived products' combustion are included.

5534 (BNL—51542, pp 95-117) **Analysis of the level of health risk posed by emission of volatile organic compounds released during continuous operation of a commercial scale coal gasification facility.** Brown, C.D. (Argonne National Lab., IL). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—). Contract W-31-109-ENG-38.

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The carcinogenic risk posed by volatile organic emissions from a coal gasifier was selected as the subject of a preliminary issue analysis to demonstrate the approach adopted by Argonne National Laboratory's program for the health and environmental risk assessment of high BTU coal gasification technology. For this analysis a unit emission rate (1 g/sec) of coal tar pitch volatiles (CTPV) was assumed to be representative of the volatile organics released by a commercial scale Lurgi gasifier producing 250 x 10^6 SCFD of synthetic natural gas. The emission was then dispersed into the 25 km^2 area immediately adjacent to the plant and a dose response relationship based on the health experience of coke oven workers was used to model a general population response to the resulting exposure. Two measures, expectation of life at birth and excess lung cancer mortality, were used to represent the level of risk associated with the CTPV emission. Results of this analysis show that the estimated emission is without any appreciable human health risk, where risk is specified as excess deaths from lung cancer. A discussion of the level of uncertainty identified during the analysis recognizes a number of sources of variation within the analysis and attempts to place range estimates on resultant overall uncertainty of the risk calculation.

5535 (BNL—51542, pp 118-129) **Modeling the potential public health impacts of airborne releases.** Meyer, H.R.; Holton, G.A. (Oak Ridge National Lab., TN). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

The US Department of Energy is currently sponsoring a project at the Oak Ridge National Laboratory focusing on the risk analysis of a hypothetical coal liquefaction industry. The summary report presented here represents a concise discussion of the methodology involved in the performance of this assessment. An attempt has been made to identify key released materials in terms of potential health effects. They include benzo(a)pyrene, cadmium, and oxides of sulfur. Data acquired from recent H-Coal pilot plant runs will allow more accurate identification and quantification of hazardous materials potentially released to the environment. Ongoing occupational health surveys are providing data on worker exposure to these materials, and may eventually allow development of worker dose-response relationships for certain materials.

5536 (BNL—51542, pp 130-165) **Municipal waste combustion.** Junk, G.A. (Ames Lab., IA). 1981. NTIS, PC A09/MF A01. File Number TI84017240. (CONF-8108134—).

From Workshop on potential public health impacts of airborne organic combustion products; Upton, NY, USA (17 Aug 1981).

Preliminary analyses have indicated an insignificant impact on public health from emissions of organic components from the co-combustion of mixtures of coal and refuse derived fuel (RDF). These risk analyses are based on an extreme paucity of data concerning both the specific organic compounds and the amounts emitted by the combustion sources coupled to the uncertainty in the data base for biological response. Some pertinent background documents related to this preliminary analysis are enclosed. Topics of discussion include: Dioxin and RDF combustion; Polychlorinated biphenyls in effluents from combustion of coal/refuse; Dioxins not detected in effluents from coal/refuse combustion.

5537 **(CONF-811086—7) Comparison of the skin tumor initiating activities of emission extracts in the SENCAR mouse.** Nesnow, S.; Triplett, L.L.; Slaga, T.J. (Environmental Protection Agency, Research Triangle Park, NC (USA); Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 13p. NTIS, PC A02. File Number DE85001548.

From 6. symposium on polycyclic aromatic hydrocarbons; Columbus, OH, USA (27 Oct 1981).

This paper describes the results of a systematic study of the ability of extracts of particulate emissions from various sources to induce benign and malignant tumors in SENCAR mice. 19 references, 1 figure, 5 tables.

5538 **(CONF-8404202—1) Summary remarks at work session on chemical dosimetry.** Turner, J.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001121.

From OHER workshop on occupational health and research; Germantown, MD, USA (26 Apr 1984).

Research is discussed that attempts to learn mechanisms and details of what takes place when metals interact with biological systems. Experiments investigating the nature and effects of chemical bonds between metals and biological molecules are described. (ACR)

5539 **(CONF-8409169—2) Multiple time measures are necessary to reduce uncertainty in dose-response modeling: time- and dose-mechanisms of the ED_{01} study.** Jones, T.D.; Dudney, C.S.; Walsh, P.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002580.

From Society for Risk Analysis annual meeting; Knoxville, TN, USA (30 Sep 1984).

Prompt cellular proliferation, resulting from toxic hyperplasia and/or normal tissue homeostasis, is required to complete carcinogenic initiation processes. Also, cell proliferation is required for carcinogenic potentiation. We have developed a mathematical model for tumorigenesis incorporating four dimensions: (1) dose, (2) exposure time, (3) sacrifice time, and (4) response. The model is based on the mechanism of compensatory cell proliferation. The fit was tested against data for tumors observed in 24,192 BALB/C mice fed 2-AAF at concentrations of 0, 35, 45, 60, 75, 100, and 150 ppM to time-of-sacrifice at 9, 12, 14, 15, 16, 17, 18, 24, and 33 months at the National Center for Toxicological Research (NCTR). Because this study was designed to measure a dose of 2-AAF needed to induce a 1% tumor rate, it has become commonly known as the ED_{01} study. The coefficients of the mathematical model were determined from the ED_{01} data and the model was then used to predict the time- and dose-equivalent of tumors in a second NCTR study of mice fed 2-AAF at concentrations of 60, 75, 100, and 150 ppM for 9, 12, and 15 months, and then sacrificed at 18 and 24 months. Previous dose-response models have not described the ED_{01} study adequately. In contrast, this four-dimensional analysis fits the dose-response quite adequately (when time-on-feed is the same as time-to-sacrifice) and is also totally predictive (without any redetermination of numerical coefficients) for the feed-wait-sacrifice protocol. 11 references, 4 tables.

5540 **(CONF-8410176—1) Development of laser-excited, fluorometric assays for the monitoring of toxic chemical exposure.** Burtis, C.A.; Egan, B.Z.; Lee, N.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002465.

From 2. international congress on automation; Barcelona, Spain (15 Oct 1984).

The microsomal mixed-function oxidase (MFO) enzyme system is involved in the metabolism of various chemical compounds. Polycylic aromatic hydrocarbons and related compounds are metabolized by the cytochrome P-448 enzyme system, which contains MFOs. Induction of this MFO activity by toxic chemicals may be useful as an indicator of the toxicity of the inducer material. A centrifugal analyzer equipped with an argon-ion laser light source was used to quantitate cytochrome P-448 activity in mouse liver microsomes. The activity was induced by exposing the animals to different doses of liquids derived from a coal-liquefaction process. The P-448 MFO activity was determined kinetically by measuring the rate at which the highly fluorescent compound, resorufin, produced by oxidation of 7-ethoxyresorufin substrate, was formed. The 514.5-nm laser excitation beam was directed with a fiber optic bundle from the laser to the cuvettes of a specially designed rotor. The emitted fluorescence, filtered through a 560-nm cut-on filter, was monitored at 90° to the incident beam. A rotor, consisting of a black, acrylic plastic center body with transparent acrylic cuvette windows, was designed and fabricated to improve the fluorescence measurements. The use of a laser excitation source allows very low MFO activities to be measured; femtomole quantities of resorufin can be determined.

5541 **(DOE/ER/60147—1) Development of in vitro mutagenicity testing systems using T-lymphocytes. Progress report, August 16, 1983-September 16, 1984.** Albertini, R.J. (Vermont Univ., Burlington (USA)). 1984. Contract AC02-83ER60147. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002225.

The objective was the development of unique cell systems for the study of mutation induction in humans. Optimal conditions for the in vitro growth of T-lymphocytes as mass cultures were defined in order to allow mutagen treatment and quantification of in vitro induced mutant frequencies. Procedures to produce T-cell growth factor were developed. (ACR)

5542 **(DOE/EV/04329—T2) Research program progress report for 1981 and proposed research for 1982-1983.** Bazzaz, F.A. (Illinois Univ., Urbana (USA). Dept. of Botany). 1982. Contract AC02-77EV04329. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002883.

Research progress in the following areas is reported: (1) the combined influence of elevated CO_2 and SO_2 concentrations on competitive interactions between species; (2) the effect of elevated CO_2 levels on plant competition and community structure in di-

verse ecosystems; and (3) change in community composition after several generations of growth under different CO_2 levels. (ACR)

5543 **(DOE/EV/04329—T3) Impact of atmospheric SO_2 and CO_2 on the ecophysiology and competitiveness of plants. Comprehensive technical progress report, 1978-1979.** Bazzaz, F.A. (Illinois Univ., Urbana (USA). Dept. of Botany). Aug 1980. Contract AC02-77EV04329. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002881.

The objective was to understand the possible changes in the structure of several plant communities which may be caused by increases in CO_2 and SO_2 concentrations, and to understand how these changes are influenced by levels of soil moisture and nutrients. 74 references. (ACR)

5544 **(DOE/OR/21400—T55) Examination of adduct formation in vivo in the mouse between benzo[a]pyrene and DNA of skin and hemoglobin of red blood cells.** Shugart, L.; Kao, J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002491.

Recent research with HPLC/fluorescence has demonstrated that we can detect, identify, and quantitate the binding of BaP with DNA of mouse skin. The technique not only allows femtomole amounts of BaPDE associated with DNA isolated from a single mouse skin to be detected using conventional instrumenthation, but also establishes the steriochemical origin of the adduct, and has been employed in the investigation reported here to estimate the concomitant binding of BaP to hemoglobin in vivo. The temporal existence of BaPDE/DNA adducts in mouse skin over a 5-week period showed that at 35 days post treatment, approximately 15% of the initial adducts were still detectable even though DNA turnover would predict that they should have been deleted from the genome. The concentration of the major covalently bound adduct, anti-BaPDE/deoxyguanosine, relative to the total BaPDE/DNA adduct population remained essentially constant during the 5-week period. It is known that topically applied BaP is absorbed, metabolized, and excreted by the mouse. Examination of hemoglobin of mouse RBCs 24 hours after BaP treatment revealed covalent adduct formation exclusively via anti-BaPDE. The dose response of adduct binding to hemoglobin and DNA appeared to be similar. 12 references, 4 figures.

5545 (Zfl-Mitt—80, pp 109-110) **Influence of high ^{13}C concentrations on the development of purple sulfur bacteria.** Ivanov, M.V.; Gogotova, G.I.; Vajnshtejn, M.B. (AN SSSR, Pushchino-na-Oke. Inst. Biokhimii i Fiziologii Mikroorganizmov). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5546 **Distribution and elimination of ingested mercuric oxide in mice.** Berg, G.G.; Smith, B.S. (Univ. of Rochester School of Medicine, NY). *Journal of the American College of Toxicology;* 2: No. 4, 307-317(1983). Contract AC02-76EV03490.

Neutron-activated mercuric oxide was administered by gavage to female BALB/c mice. Counts of ^{197}Hg and ^{203}Hg in the whole body, urine, and feces were followed for up to 36 days. Elimination of mercury fitted a 3-compartment model. Nonpregnant mice eliminated approximately 87.5% of the dose at a fast rate (t/sub 1/2/ = 9 hours), 12% at an intermediate rate (t/sub 1/2/ = 2days), and 0.5% at a slow rate (t/sub 1/2/ = 15 days). Each half-time was approximately 7 times shorter than the corresponding half-time fitted to published data on rats. Mice were also faster than humans in eliminating the ingested mercury. Pregnancy slowed down the intermediate rate of elimination. The total administered dose was recoverd for feces and urine in a 9:1 ratio. Organ weights and mercury burdens were measured after serial sacrifice. Peak concentrations were reached within two days, with highest levels in kidneys followed by placentae and livers. In brains, peak concentrations were delayed and low. Subsequent losses of mercury differed widely in rate constants, with fastest overall rates in the brain, intestine, and integument, followed in order by whole body, liver, and kidneys. Ten days after dosing, mercury concentration ratios of placenta to 17-day old fetus were 20:1, 11 days after dosing, and with less than 2% of body burden remaining, while body concentration ratios of mother to neonate were 4:1. The data indicated that mice eliminated mercuric salts faster than had been reported for rats or humans, and that rapid elimination coupled with a placental barrier shielded fetuses from equilibrating with the peak concentrations of mercury found in dams after a single dose.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 5604005502

5547 **(AD-A—144150/0) Study of the interaction of millimeter wave fields with biological systems. Final report.** Lawrence, A.; Pierce, B.; McDaniel, J.; Chang, D. (Hughes Aircraft Co., Long Beach, CA (USA). Support Systems Div.). Jul 1984. 57p. NTIS, PC A04/MF A01.

Our study of the interaction of millimeter wave fields with biological systems has concentrated on Davydov's model of soliton formation in alpha-helices. A qualitative understanding has been obtained for the oscillatory modes of proteins in the millimeter and submillimeter regions of the electromagnetic spectrum. Four separate groups of frequencies are found to exist in short alpha-helices, ranging from 200 gigahertz to 6 terahertz. In long alpha-helices, soliton trapping is predicted for multiquanta excitation at zero temperature, while the existence of solitons at room temperature is called into question. A molecular orbital calculation of the exciton-phonon coupling constant in the formamide dimer suggests that the value of this critical constant still needs to be determined. The results point up the need for further molecular orbital calculations and experimental verification in order to understand the interaction of millimeter waves with biological systems.

5548 **(AD-A—144210/2) Visual Function Changes after laser exposure. Final report 1973-1983.** Zwick, H. (Letterman Army Inst. of Research, San Francisco, CA (USA)). Apr 1984. 32p. (LAIR—84-48). NTIS, PC A03/MF A01.

Contents: Visual Function Changes after Chronic or Low-light Exposure, and Experimental Assessments of Vision Changes in the Non-human Primate following Acute Laser Exposures.

5549 **(CONF-841041—1) ELF bioeffects: use of negative data in a structured argument.** Easterly, C.E.; Aldrich, T.E.; Morris, M.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002579.

From 23. Hanford Life Sciences symposium--interaction of biological systems with static and ELF electric and magnetic fields; Richland, WA, USA (2 Oct 1984).

Data on effects of ELF fields reported in human studies is contrasted with that from laboratory studies. A growing body of human evidence suggests a possible relationship between ELF field exposure and cancer. No direct supportive or antagonistic evidence is available in laboratory data and indirect evidence is relatively neutral. Only a few recent laboratory studies might support inferences based upon human studies. In an attempt to reconcile human and laboratory data, careful reanalysis, especially of reported laboratory no-effects data, can be useful. 21 references, 3 tables.

5550 **(DOE/RA/50219—T3) Study of the behavioral and biological effects of high strength 60 HZ electric fields. Quarterly technical progress report No. 15, 12 May 1984-3 August 1984.** (Southwest Research Inst., San Antonio, TX (USA)). 15 Aug 1984. Contract AC02-80RA50219. 14p. NTIS, PC A02. File Number DE84000577.

Progress is reported in the construction of a test facility for studying the effects of high intensity, 60 Hz electric fields on baboons. Effects to be studied include operant out social behaviors. (ACR)

5551 (FS—83-30-T, pp 541-544) **Laser equipment, safety assessment and measurements for radiation protection purposes.** Fischer, P.G.; Witew, B. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The measurements for the safety assessment of laser equipment are to provide data on compliance with limiting values. Various measuring methods can be applied. Calorimetric methods rely on the heating of the detector by the absorbed laser radiation. Other measuring instruments, such as photodiodes or photocells, make use of photoelectric effects. All instruments have to meet the following requirements: (1) Little dependence on wave length. (2) Large measuring range. (3) Measurement of both continuous and pulsed radiation. (4) Low susceptibility to external impacts (such as heat sources, noise). In most cases, the instruments do not meet all these requirements so that two or even more instruments have to be used simultaneously. Another factor of importance are accessory devices such as diaphragma, reducing apparatus, monochrometers. It is not possible to completely measure the space around a laser equipment. One has to select crucial points, or point of special interest, by careful assessment or calculation.

5552 **(PB—84-230358) Human reactions to ELF (extremely low frequency) electric and magnetic fields - an annotated bibliography of current literature. Fourth edition. Final report.** Reilly, J.P. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Jun 1984. 118p. NTIS, PC A06/MF A01.

See also PB83-259648.

The annotated bibliography lists current literature (since 1960) which applies to human reactions to electric and magnetic fields from 10 Hz to 100 Hz, with an emphasis on power frequency fields. This includes direct experimental work with humans, epidemiological studies, works which use animal studies to draw interferences about human reactions, studies concerning human dosimetry, and works which discuss means for human protection. This bibliography was first published in July 1981. The fourth edition includes material obtained through June 1984.

5553 **(PB—84-236603) Thermoregulatory consequences of long-term microwave exposure at controlled ambient temperatures. Final report.** Adair, E.R.; Spiers, D.E.; Rawson, R.O.; Adams, B.W.; Sheldon, D.K. (John B. Pierce Foundation of Connecticut, Inc., New Haven (USA)). Aug 1984. 91p. NTIS, PC A05/MF A01.

The study was designed to identify and measure changes in thermoregulatory response systems, both behavioral and physiological, that may occur when squirrel monkeys are exposed to 2450-MHz CW microwaves 40 hours/week for 15 weeks. Microwave power densities explored were 1 and 5 mW/sq. cm. (SAR = 0.16 W/kg per mW/sq. cm.) and were presented at controlled environmental temperatures of 25, 30, and 35 C. Standardized tests, conducted periodically, assessed changes in thermoregulatory responses. Dependent variables measured included body mass, certain blood properties, metabolic heat production, sweating, skin temperatures, deep body temperature, and behavioral responses by which the monkeys selected a preferred environmental temperature. Results showed no alteration of metabolic rate, internal body temperature, or thermoregulatory behavior by microwave exposure although the ambient temperature prevailing during chronic exposure could exert an effect. An increase in sweating rate occurred in the 35 C environment, not enhanced significantly by microwave exposure. Skin temperature, reflecting vasomotor state, was reliably influenced by both ambient temperature and microwaves. The most robust consequence of microwave exposure was a reduction in body mass which appeared to be a function of microwave power density.

5554 **Human body impedance for electromagnetic hazard analysis in the VLF to MF band.** Kanai, H.; Chatterjee, I.; Gandhi, O.P. (Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112, on sabbatical from Sophia University). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques;* **MTT-32**: No. 8, 763-772(Aug 1984).

A knowledge of the average electrical impedance of the human body is essential for the analysis of electromagnetic hazards in the VLF to MF band. The purpose of the measurements was to determine the average body impedance of several human subjects as a function of frequency. Measurements were carried out with the subjects standing barefoot on a ground plane and touching various metal electrodes with the hand or index finger. The measured impedance includes the electrode polarization and skin impedances, spread impedance near the electrode, body impedance, stray capacitance between the body surface and ground, and inductance due to the body and grounding strap. These components are separated and simplified equivalent circuits are presented for body impedance of humans exposed to free-space electromagnetic waves as well as in contact with large ungrounded metallic objects therein.

5555 **Average SAR and SAR distributions in man exposed to 450-MHz radiofrequency radiation.** Guy, A.W.; Chou, C.K.; Neuhaus, B. (Bioelectromagnetics Research Laboratory RJ-30 University of Washington, Seattle, WA 98195). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques;* **MTT-32**: No. 8, 752-763(Aug 1984).

Fifth-scale phantom models were exposed to 2450-MHz electromagnetic fields to obtain the average specific absorption rate (SAR) and SAR distribution in man exposed to 1 mW/cm^2 450-MHz radiofrequency radiation for various polarizations and body positions. The average SAR was measured calorimetrically and SAR distribution was determined thermographically using an interactive computer system. The mean SAR, as averaged over the body, remained relatively constant at 0.050 W/kg, with a standard deviation of + or - 0.007 W/kg for all polarizations and body postures considered in the study. Peak SAR values were as high as 0.650 W/kg, occuring typically in the wrist.

5556 **Limitations of the cubical block model of man in calculating SAR distributions.** Massoudi, H.; Durneg, C.H.; Iskander, M.F. (Department of Electrical Engineering, University of Utah, Salt Lake City, UT 84112). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques;* **MTT-32**: No. 8, 746-752(Aug 1984).

Block models of man which consist of a limited number of cubical cells are commonly used to predict the internal electromagnetic (EM) fields and specific absorption rate (SAR) distributions inside the human body. Numerical results, for these models, are obtained based on moment-method solutions of the electric-field integral equation (EFIE) with a pulse function being used as the basis for expanding the unknown internal field. In this paper, the authors first examine the adequacy of the moment-method procedure, with pulse basis functions, to determine SAR distributions in homogeneous models. Calculated results for the SAR distributions in some block models are presented, and the stability of the solutions is discussed. It is shown that, while the moment-method, using pulse basis functions, gives good values for whole-body average SAR, the convergence of the solutions for SAR distributions is questionable. A new technique for improving the spatial resolution of SAR distribution calculations using a different EFIE and Galerkin's method with linear basis functions and polyhedral mathematical cells is also described.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 5700004471, 4616, 4617, 4618, 5080, 5111, 5362, 5363, 5521

5557 (EPRI-EL—3581, pp 6.21-6.34) **Polychlorinated dibenzofurans and PCB-transformer fires: toxic hazards and determination of decontamination guidelines.** Milby, T.H.; Forrester, T.L. (Pacific Gas and Electric Co., San Francisco, CA). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

When exposed to high temperatures, PCBs form polychlorinated dibenzofurans (PCDF). This phenomenon has been demonstrated in connection with PCB-containing transformer fires. These fires can create very serious problems of environmental contamination. At least two methods have been used for establishing standards for acceptable levels of cleanup following such fires. One method assumes that the major hazard to human health represented by the PCB-PCDF mixture is carcinogenesis. The second approach is based on the establishment of an acceptable daily intake, most often based on a no-observed effect level (NOEL) from animal study data. These two methods are discussed and evaluated.

5558 (EPRI-EL—3581, pp 6.35-6.57) **Search for PCB health effects.** Brown, J.F. Jr. (General Electric Research and Development Center, Schenectady, NY). Jun 1984. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI84920501. (CONF-831287—).

From EPRI PCB seminar; Atlanta, GA, USA (6 Dec 1983).

Research on the chemical, physical, environmental, biological, and medical properties of PCBs is discussed. It was concluded that PCB exposures at the high levels provided by prolonged, direct occupational contact had no reproducibly observed effects upon the health of the vast majority of the exposed individuals. There seems to be little basis for concern over the health risks presented by environmental exposure to residual PCBs at today's levels.

5559 **(HEDL-SA—3193-FP) Westinghouse Quality Circles: employee participation in resolving health and safety problems.** Bell, J.R. (Hanford Engineering Development Lab., Richland, WA (USA)). 9 Aug 1984. Contract AC06-76FF02170. 14p. (CONF-840963—4). NTIS, PC A02. File Number DE85001427.

From DOE and DOE contractors' occupational safety and health conference; San Diego, CA, USA (11 Sep 1984).

A Quality Circle is a group of 4 to 10 employees performing similar work who volunteer to meet regularly, on company time, to identify the cause of on-the-job problems and to propose solutions to management. This report discusses what Quality Circles are, how they function, the types of problems they deal with, and why they work. (ACR)

5560 **(HEDL-SA—3198-FP) Curriculum approach to safety training.** Zimmerman, R.O. (Hanford Engineering Development Lab., Richland, WA (USA)). 10 Sep 1984. Contract AC06-76FF02170. 11p. (CONF-840963—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001063.

From DOE and DOE contractors' occupational safety and health conference; San Diego, CA, USA (11 Sep 1984).

The main objectives for Safety Training are to help employees: spot and resolve unsafe acts and conditions, know and/or set safety standards and develop safe work habits. Safety Training's effectiveness increases as management pays closer attention to matching the needs of employees to the objectives of the training. A theory of learning was identified that discusses the different levels of learning. The theory, Bloom's Taxonomy, is widely used in education as an aid in forming objectives. A spiral concept was developed to illustrate how retraining could be accomplished that increases the depth of understanding. Several curriculum and problem solving views are also presented. 7 figures, 1 table.

5561 **(LA—9958-PR) Occupational Health and Environmental Research Program of the Health Division, 1982. Progress report.** Voelz, G.L. (comp.). (Los Alamos National Lab., NM (USA)). Sep 1984. Contract W-7405-ENG-36. 113p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85002304.

Worker protection studies primarily involve investigating respirators, protective clothing, and radiation dosimetry. Evaluations of respiratory protective equipment in 1982 included 3 special DOE contractor devices, 10 commercial supplied-air devices, 2 military respirators, and 3 powered air-purifying respirator systems that will be used in nuclear facilities. Permeation rates for a number of different chemicals were determined in 11 materials. Estimates of plutonium deposition in workers were calculated from urine excretion data, and they were compared with plutonium measurements in autopsy tissues. Field industrial hygiene studies of oil shale processes were continued at the Rio Blanco and the Occidental facilities in Colorado and the Geokinetics facility in Utah. Studies of Los Alamos and Rocky Flats plutonium workers have shown no increased mortality compared with US vital statistics. A summary of analytical-chemistry methods used for environmental measurements is provided. Developments in analytical methods are discussed for beryllium, PCBs, uranium, plutonium, and americium. Environmental surveillance at Los Alamos during 1982 showed that the highest estimated radiation dose from Laboratory operations is about 7% of the natural radiation background dose. Controlled-air incineration of combustible wastes continued to contain fission and activation products well and to reduce feed material volume efficiently. A continuous slurry-feed system for ion-exchange resins and decomposition of PCBs were both demonstrated successfully in the incinerator. Methods and alternate test aerosols were evaluated for QA testing of HEPA filters. 28 figures, 41 tables.

5562 **(ORNL—6076) Health and Safety Research Division progress report, October 1, 1982-June 30, 1984.** Kaye, S.V. (Oak Ridge National Lab., TN (USA)). Aug 1984. Contract AC05-84OR21400. 129p. NTIS, PC A07/MF A01; GPO Dep. File Number DE84017641.

The work accomplished by the Health and Safety Research Division, Oak Ridge National Laboratory is summarized. Research, assessments and technical measurements done by the division between October 1982 and June 1984 are summarized. Separate analytics were written for each chapter.

5563 **(SRD-R—299) FIRENET - a program for performing probabilistic risk assessment of fires in buildings.** Hall, S.F.; Scattergood, W.M. (UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate). Jun 1984. 18p. UKAEA, Wigshaw Lane, Culcheth Warrington, WA3 4NE, England. File Number TI85900203.

This report describes a computer program, FIRENET, which calculates the frequencies of sets of components being failed by fire. The components and their associated cabling and controls are assumed to be contained within a network of volumes, whose interconnections represent segregating fire barriers. Fire initiation frequencies for each volume and conditional probabilities for fire probabilities for fire propagation along each inter-connection are given. Similarly conditional failure probabilities are given for each component in each volume in which it exists. From these data the total frequency of failure of sets of components (representing minimal cut sets of system of interest) from all paths within the network are calculated. 3 figures.

5564 **(UCRL—50007-83) Hazards Control Department annual technology review, 1983.** Griffith, R.V. (ed.). (Lawrence Livermore National Lab., CA (USA)). 15 Jun 1984. Contract W-7405-ENG-48. 91p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85001434.

This report presents research results in the areas of industrial hygiene, radiation protection, fire safety, and instrument development. Items have been individually abstracted. (ACR)

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 5800005623

5565 **(CSIR-SR-FIS—320) Annual report July 1982-June 1983.** (Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.). Oct 1983. 105p. (In Afrikaans). NTIS (US Sales Only), PC A06/MF A01. File Number DE84703313.

This report covers the activities of the National Physical Research Laboratory for the period July 1982 - June 1983. Research was done in the fields of physics and earth and atmospheric sciences, including acoustics, national measuring standards and metrology, optical sciences, geochronology, geophysics and natural isotopes. A sound intensitometer was developed to get a perspective view of an optical system from any given angle. Work was started on a research program regarding infra-red roman distribution. Radiometric dating was done on the Taung tuff. Research was also done on various materials in the earth atmosphere, air pollution in the Transvaal Highveld area and the Archean greenstone belt.

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 5801004380, 5414, 5603

5566 **(AD-A—144331/6) Chaffey Hillside Site, CA-SBR-895; report of the cultural resource mitigation program.** Allen, L.P. (Archaeological Resource Management Corp., Garden Grove, CA (USA)). Jan 1982. 153p. NTIS, PC A08/MF A01.

The archaeological portion had as its subject the Chaffey Hillside Site at the base of the San Gabriel Mountains overlooking the Cucamonga area of the Pomona Valley. The site represents a small cyclically re-occupied camp at least 1300 years old. Activities at the camp appear to have focused on the extraction and processing of plant materials, specifically yucca and oak. Included in the report are sections dealing with the natural and cultural contexts of the site, field procedures used, radiocarbon dates and obsidian hydration measurements obtained, and probable lithic source areas along with detailed accounts of the artifacts, debitage, and faunal remains recovered. Also included is a discussion of the problems in the application of existing cultural historical frameworks to sites in the interior portions of the greater Los Angeles Basin, and some predictions of what might be expected at other sites in the region if the reconstruction offered for the settlement system. Included among the appendices are discussions of the geologic history of the region as it applies to lithic resources of interest to the site's inhabitants and the soil stratification encountered.

5567 **(DOE/OR/20722—6) Geologic report for the Weldon Spring Raffinate Pits Site.** (Bechtel National, Inc., Oak Ridge, TN (USA)). Oct 1984. Contract AC05-81OR20722. 410p. NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85003149.

A preliminary geologic site characterization study was conducted at the Weldon Spring Raffinate Pits Site, which is part of the Weldon Spring Site, in St. Charles County, Missouri. The Raffinate Pits Site is under the custody of the Department of Energy (DOE). Surrounding properties, including the Weldon Spring chemical plant, are under the control of the Department of the Army. The study determined the following parameters: site stratigraphy, lithology and general conditions of each stratigraphic unit, and groundwater characteristics and their relation to the geology. These parameters were used to evaluate the potential of the site to adequately store low-level radioactive wastes. The site investigation included trenching, geophysical surveying, borehole drilling and sampling, and installing observation wells and piezometers to monitor groundwater and pore pressures.

5568 (ZfI-Mitt—80, pp 73) **Control of standardized measuring conditions in ^{14}C dating.** Goersdorf, J. (Akademie der Wissenschaften der DDR, Berlin. Zentralinstitut fuer Alte Geschichte und Archaeologie). Nov 1983. (In German). B. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5569 (ZfI-Mitt—80, pp 76) **Variations in the isotopic composition of uranogenic and thorogenic lead and their significance for investigations of geochronology and genesis of ore and rocks.** Amov, B.G. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5570 (ZfI-Mitt—80, pp 77) **New results of lead isotope ratios of feldspars, granites, and ores from South Bulgaria.** Amow, B.; Arnaudow, V.; Baldjiewa, Z.; Pawlowa, M. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5571 (ZfI-Mitt—80, pp 78) **$^{40}Ar/^{39}Ar$ - age estimation of biotite.** Kaiser, G.; Pilot, J. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5572 (ZfI-Mitt—80, pp 79) **Potassium/calcium isochrones of sylvinites from the Sibirian tableland.** Lepin, W.S.; Jegorowa, T.W.; Brandt, S.B. (AN SSSR, Irkutsk. Inst. Organicheskoj Khimii). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5573 (ZfI-Mitt—80, pp 80) **Contribution to the elucidation of the genesis of granites from the western and central part of the Ore Mountains by means of $^{87}Sr/^{86}Sr$ ratios.** Gerstenberger, H.; Haase, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5574 (ZfI-Mitt—80, pp 81) **Geochronologic and genetic modelling of granitoids from the western part of the Ore Mountains and from Vogtland.** Kaemmel, T. (Martin-Luther-Universitaet Halle-Wittenberg, Halle (German Democratic Republic)). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5575 (ZfI-Mitt—80, pp 82) **Assessment of age differences within the pluton of the Ore Mountains based on isotope data.** Kaemmel, T. (Martin-Luther-Universitaet Halle-Wittenberg, Halle (German Democratic Republic)). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5576 (ZfI-Mitt—80, pp 83) **Theoretical aspects of radiogeochronologic dating of rocks and minerals.** Christoph, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5577 (ZfI-Mitt—80, pp 115-116) **Experiments on ^{14}C dating of Antarctic storm petrel's breeding-places.** Hiller, A.; Wand, U. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5578 (ZfI-Mitt—80, pp 95) **Deuterium variations of granites and mica schists in the contact area of an intrusive body of the central part of the Ore Mountains.** Boettger, T.; Stiehl, G.; Muehle, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5579 (ZfI-Mitt—80, pp 105-107) **Strontium, oxygen, and carbon isotopes in carbonates of kimberlites from Yakutia.** Dnjeprowskaja, L.W.; Maslowskaja, M.N.; Brandt, S.B. (AN SSSR, Irkutsk. Inst. Zemnoj Kory). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5580 (ZfI-Mitt—80, pp 119-120) **Isotopic characteristic of the tithonian reef Stramberk Limestone (Czechoslovakia, West Carpathians).** Hladikova, J.; Eliasova, H.; Elias, M. (Cesky Geologicky Urad, Prague (Czechoslovakia)). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5581 (ZfI-Mitt—80, pp 126-127) **Investigations of ^{18}O variations of granites and mica schists in the contact area of an intrusive body of the central part of the Ore Mountains.** Muehle, K.; Stiehl, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Borschtschewski, Yu.A.; Medwedowskaja, N.I. (AN SSSR, Moscow. Inst. Litosfery). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5582 (ZfI-Mitt—80, pp 133) **Nitrogen isotope variations of granites and mica schists in the contact area of an intensive body of the central part of the Ore Mountains.** Stiehl, G.; Haendel, D.; Guenther, U. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5583 (ZfI-Mitt—80, pp 38-39) **Carbon isotope study of the development of the Old Paleozoic in the Thuringian Slate Mountains.** Hahne, K.; Luetzner, H.; Ellenberg, J.; Falk, F.; Grumbt, E. (Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Physik der Erde); Maass, I. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5584 (ZfI-Mitt—80, pp 108) **Systematics of underground brine deposits for potash mining.** Elert, K.H.; Schmiedl, H.D. (VEB Kombinat Kali, Sondershausen (German Democratic Republic)); Jordan, H. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften); Stiehl, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5585 (ZfI-Mitt—80, pp 5-6) **Contributions of isotope geology to the elucidation of the continental growth.** Wetzel, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5586 (ZfI-Mitt—80, pp 87-88) **Investigation of recent mineralization processes in deep holes and mines by means of ^{228}Ra, ^{224}Ra, and ^{226}Ra.** Just, G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik); Lehnert, K. (Forschungsinstitut fuer die Erkundung und Foerderung von Erdoel und Erdgas, Gommern (German Democratic Republic)); Loos, G. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).
Published in summary form only.

5802 Geophysics

REFER ALSO TO CITATION(S) 5802004221, 4222, 4224, 4278, 4743, 5294, 5295, 5435

5587 **(AD-A—143213/7) Wave propagation in dense geophysical media. Final report 1 April 1981-31 March 1984.** Ishimaru, A. (Washington Univ., Seattle (USA)). 12 Jun 1984. 8p. NTIS, PC A02/MF A01.

This final report summarizes our study of the interactions between the wave characteristics and the dense geophysical media.

We have clarified the propagation constant of the coherent wave in a dense medium, conducted a pulse-broadening study, observed an interesting backscattering phenomenon, and investigated vector radiative transfer theory.

5588 **(AD-A—144610/3) Large-scale numerical analysis of three-dimensional seismic waves. Final report 1 October 1982-30 September 1983.** Wojcik, G.L.; Vaughan, D.K. (Weidlinger Associates, Menlo Park, CA (USA)). 31 May 1984. 53p. (R—8403). NTIS, PC A04/MF A01.

This report concludes our study of large-scale vectorized numerical analysis applied to time domain seismic wave phenomena in filled basins. Applications include calculations of waves from simple surface or buried sources in a variety of idealized 2-D Basin and Range models (36,000 to 120,000 nodes) described in an interim report, and one large 3-D model (400,000 nodes) from Yucca Flat, Nevada Test Site, described here. Analysis is based on an explicit, finite element, elastic wave solver designed for vectorized execution on the CRAY-1. The primary result of the present 3-D study is that, given the database available from investigations in Yucca Flat, Nevada Test Site, the size of feasible 3-D computational models on the CRAY-1S is adequate to simulate elastic wave fields and interpret arrivals for comparison with existing 3-D ground motion data. Synthetic seismograms from a 400,000 element 3-D simulation of the COALORA event a Yucca Flat indicate that a significant source of transverse motion on radial lines through the source is diffraction from a discontinuity in the Rainier Mesa tuff layer across the Yucca fault. Successful time-domain simulations in 3-D are feasible with pipelined supercomputers but optimal processing requires careful tailoring of the algorithm to vectorize inner code loops and eliminate nonessential arithmetic.

5589 **(DOE/ER/10933—T1) Crustal stretching and subsidence in sedimentary basins: a pilot study in the Austro-Alpine nappes of eastern Switzerland and permo-carboniferous basins in the continental United States. Final report.** Dewey, J.F. (State Univ. of New York, Albany (USA)). 9 Oct 1984. Contract AC02-81ER10933. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000622.

The Austro-Alpine nappe complex of eastern Switzerland, together with the southern Alps, represents the thinned continental crust of the southern margin of the Alpine trough whose demise led to the growth of the Alps. Detailed and systematic structural mapping in parts of the Austro-Alpine Nappes have allowed us to reconstruct the stretching factor, β, and its variability across the basin margin from which the subsidence and thermal history of a large rift complex has been deduced. From this, a basic picture has been derived of the mechanical behavior of the stretched crust-lithosphere during the attenuation process and a knowledge of lithospheric behavior during the prolonged period of Jurassic-Cretaceous cooling. A systematic and very detailed study has also been made of the stratigraphic-structural-thermal maturation history of the intracontinental Pennsylvanian-Permian basins and troughs of Colorado, Texas, and Oklahoma. (ACR)

5590 **(DOE/ET/14389—T1) Structure and application of extremely large geophysical data bases. Final report.** Escowitz, E.C. (Geological Survey, Reston, VA (USA)). 1984. Contract AI01-80ET14389. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003527.

A unique data-base design has been devised to handle massive quantities of gridded geophysical data and to support a variety of marine geologic applications. The structure of the data base allows for storage of mean grid-point values with covariables (number of observations, maximum, minimum, and standard deviation). The Geographic Review and Cursor Editing (GRACE) program has been written for data-base manipulation. A limited fine mesh option in the data base permits increased resolution in special study areas. The data-base design has been applied to marine bathymetric, magnetic, and gravity data.

5591 **(SAND—83-2625) Proceedings of the conference on DOE ground motion and seismic programs on, around, and beyond the NTS.** Vortman, L.J. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Jun 1984. Contract AC04-76DP00789. 430p. (CONF-8111147—). NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE84015938.

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Individual papers from this conference were processed for inclusion in the Energy Data Base.

5592 (SAND—83-2625, pp 5-49) **Significance of earthquake and weapons-test ground motion to structure response and NRC licensing.** Blume, J.A. (URS/John A. Blume and Associates, Engineers, San Francisco, CA). Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

The author feels that of all the problems to be resolved before a nuclear power plant can be licensed to operate, the earthquake problem is the most difficult from the emotional and public relations point of view, as well as technically. It is the one that intervenors and their lawyers thrive upon, as do the demonstrators. These earthquakes can be tectonic, reservoir induced, and/or imaginary. 9 references, 29 figures.

5593 (SAND—83-2625, pp 51-73) **History of ground motion programs at the Nevada Test Site.** Banister, J.R. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Some measurements were made in the atmospheric testing era, but the study of ground motion from nuclear tests became of wider interest after the instigation of underground testing. The ground motion generated by underground nuclear test has been investigated for a number of reasons including understanding basic phenomena, operational and safety concerns, yield determination, stimulation of earthquake concerns, and developing methods to aid in treaty verifications. This history of ground motion programs will include discussing early studies, high yield programs, Peaceful Nuclear Explosions tests, and some more recent developments. 6 references, 10 figures.

5594 (SAND—83-2625, pp 75-102) **Ground motion measurements to support the DOE-NV safety program.** Honda, K.K. (URS/John A. Blume and Associates, Engineers, San Francisco, CA). Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

In support of DOE-NV's safety program, URS/Blume is conducting a seismic documentation program with the primary objective of measuring, for analysis and evaluation, the ground and structural-response motion resulting from underground nuclear explosions (UNEs). Until 1979, instruments were deployed to record seismic activity originating outside the NTS as well, but deployment is now limited to the communities surrounding the NTS. The majority of the instruments are now installed in the high-rise buildings that have proliferated in Las Vegas in recent years. Our seismic-motion measuring equipment varies from accelerographs that record motion on photographic paper to systems that digitize and record data on cassettes. However, our basic workhorse is the L-7 velocity meter system, which records up to 12 channels of data on FM tape. Depending on need, site accessibility, and type of system, either source motion or a radio trigger activates the system. The system can also record continuously. On one building, a laser was used to record both transient and steady-state motion. Data processing centers around a minicomputer. In the current configuration, analog and digital playback equipment is integrated into the total processing system. The minicomputer performs basic processing, such as peak amplitude scaling; signal conditioning; differentiation and integration; and generation of response spectra. More complex analysis is done on larger computers elsewhere. The results are useful to various DOE-NV support groups. 12 references, 19 figures.

5595 (SAND—83-2625, pp 143-215) **Nevada Nuclear Waste Storagge Investigations' weapons test seismic investigations.** Vortman, L.J. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

The overall purpose of the Weapons Test Seismic Investigations is to assure compatibility of a nuclear waste storage facility at the Nevada Test Site with the weapons testing program from the standpoint of ground motion generated by weapons tests. To carry out the purpose, four specific objectives have been defined: (1) to develop a capability of predicting ground motion within the test site from underground nuclear weapons tests as it would be imposed on a nuclear waste storage facility; (2) to determine the effect of repository depth and geology on ground motion from the weapons test; (3) to develop an understanding of larger-than-predicted accelerations observed at NRDS on past weapons tests, and to determine if the site of a nuclear waste storage facility is subject to similar large accelerations; and (4) to provide a data bank of ground motion from weapons tests which will provide the background base for facility design and for NRC licensing. How these objectives are being met is discussed. 59 figures, 2 tables.

5596 (SAND—83-2625, pp 245) **LLNL off-site seismic net.** Followill, F.E. (Lawrence Livermore National Lab., CA). Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

5597 (SAND—83-2625, pp 247-265) **Sandia National Labs (SNL) off-site seismic net.** Brady, L.F.; Garbin, H.D. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Sandia National Laboratories has monitored NTS since 1960 in an ongoing effort to obtain prompt yield estimates. The net evolved over several years to its present layout which includes five stations distributed around the Test Site. Each station consists of short-period and wideband (0.1 to 10 Hz) instruments which are recorded on analog tape. Presently the data acquisition system is undergoing a transformation from the analog scheme to a digital system. Over the years, techniques used for the yield estimates have been refined in both areal and master event comparisons with +- 25 percent error estimates. With the new digital system, some new automated methods will be attempted to reduce the uncertainties in the yield estimates by using a larger statistical base and perhaps new analytical methods. 3 figures.

5598 (SAND—83-2625, pp 269-302) **National Seismic Station.** Stokes, P.A.; Durham, H.B. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

The National Seismic Station was developed to meet the needs of regional or worldwide seismic monitoring of underground nuclear explosions to verify compliance with a nuclear test ban treaty. The Station acquires broadband seismic data and transmits it via satellite to a data center. It is capable of unattended operation for periods of at least a year, and will detect any tampering that could result in the transmission of unauthentic seismic data. 55 figures.

5599 (SAND—83-2625, pp 303-342) **Southern Great Basin Seimological data report for 1980 and preliminary data analysis.** King, K.W.; Engdahl, E.R. (Geological Survey, Denver, CO). Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Earthquake data for the calendar year 1980 are presented for earthquakes occurring within and adjacent to the southern Nevada seismograph network. Locations, magnitudes, and selected focal mechanisms for these events and events from prior years of network operation are presented and discussed in relation to the geologic framework of the region. The principal results are that (1) earthquakes concentrate in fault zones having a northeast orientation, (2) fault zones having a northwest orientation are quiescent or nearly so, and (3) no earthquakes have been detected closer than 12 km to the Yucca Mountain nuclear waste repository study area. 12 references, 13 figures.

5600 (SAND—83-2625, pp 391-423) **Seismic investigations for the Waste Isolation Pilot Plant.** Barrows, L.J. Jun 1984. NTIS, PC A19/MF A01. File Number TI84015938. (CONF-8111147—).

From Conference on ground motion and seismic programs; Albuquerque, NM, USA (4 Nov 1981).

Evaporite rocks in the Delaware Basin in southeastern New Mexico are being investigated as a possible site for nuclear waste disposal. Seismic studies have been conducted to establish seismic design criteria and to investigate relations between seismicity and geologic structures. In the initial phase of this study, historical and available seismic data were interpreted with respect to geology. Local instrumentation became available in 1974 when New Mexico Tech installed and began operating a seismic station in the area. Data and interpretation for 1974 through 1979 have been published. In 1980 seismic monitoring of the Northern Delaware Basin was extended to include a six station network of self-contained radiotelemetered seismometers. 9 references, 13 figures.

5601 **Magnetotelluric and geomagnetic deep-sounding studies in rifts and adjacent areas: constraints on physical processes in the crust and upper mantle.** Hermance, J.F. (Brown Univ., Providence, RI). *Am Geophys Union Continental and Oceanic Rifts Geodynamics Series;* **8**: 169-192(1982). Contract AC02-79ER10401.

Deep electrical studies are reviewed along with other supportive geophysical/geological investigations of five of the major rift zones of the world: the Baikal rift, and Rhine graben, the East African rift, Iceland and the Rio Grande rift. All of these regions exhibit anomalously low values of electrical resistivity, density and seismic velocity, either within the crust itselt or at high levels in the mantle. Deep electrical studies support a model where ascending masses of material from the mantle are intimately coupled to the fractionation of a basalt melt and its accumulation at higher levels within the earth. In Iceland, an interplate rift, the accumulation and chilling of melt at the base of the crust apparently leads to a significant component of crustal underplating whereas in intraplate rifts such as the Rio Grande rift, the emplacement of basaltic magma at high levels may lead to extensive remelting of the crust, triggering eruptive episodes of silicic magmas.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 5803004215, 4219, 4371, 5023, 5586

5602 **(CONF-841157—13) Behavior of nuclear waste elements during hydrothermal alteration of glassy rhyolite in an active geothermal system: Yellowstone National Park, Wyoming.** Sturchio, N.C.; Seitz, M.G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002730.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The behavior of a group of nuclear waste elements (U, Th, Sr, Zr, Sb, Cs, Ba, and Sm) during hydrothermal alteration of glassy rhyolite is investigated through detailed geochemical analyses of whole rocks, glass and mineral separates, and thermal waters. Significant mobility of U, Sr, Sb, Cs, and Ba is found, and the role of sorption processes in their observed behavior is identified. Th, Zr, and Sm are relatively immobile, except on a microscopic scale. 9 references, 2 figures, 2 tables.

5603 **(FLPU—83-9) Petrography of the Jurassic core from the Harwell research site. Part 1: Kimmeridge Clay, Corallian Beds and Oxford Clay.** Milodowski, A.E.; Wilmot, R.D. (Institute of Geological Sciences, Harwell (UK). Fluid Processes Unit). Jun 1983. 110p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85780096.

Detailed examination by mineralogical and petrological techniques has enabled a detailed characterisation of the lithologies of the Oxford Clay, Corallian Beds and the Kimmeridge Clay beneath the Harwell Research Site. Information obtained has revealed the

nature of the bulk mineralogy, pore-types, pore-surface mineralogy and post-depositional alteration of the rocks. Diagenesis has played an important part in determining the mineralogy, porosity and fabric of the rocks and has had the greatest variation of effects in the Corallian Beds, determining the phases now in contact with groundwater. It is these authigenic phases that are of key interest in assessing the behaviour of radionuclides which may be released into the local groundwater systems. The importance of the different pore-types characterised during this investigation and of the mineral phases lining these potential pathways for groundwater movement are discussed in detail at the end of this report. Diagenesis has reduced primary porosity in many of the Corallian rocks by calcite precipitation. In such rocks where a cohesive cement is present, groundwater flow must occur along large-scale fractures and more slowly along intercrystalline grain-boundary cracks.

5604 **(UCRL—53552) Reaction of the Topopah Spring tuff with J-13 well water at 90°C and 150°C.** Oversby, V.M. (Lawrence Livermore National Lab., CA (USA)). 30 May 1984. Contract W-7405-ENG-48. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85003157.

As part of the Nevada Nuclear Waste Storage Investigations Project, the Lawrence Livermore National Laboratory is responsible for the design and testing of waste packages suitable for use in the Topopah Spring tuff at Yucca Mountain. Definition of the physical and chemical environment of the waste package is part of that task. This report describes a series of hydrothermal experiments using crushed tuff from the Topopah Spring Member and natural groundwater from Well J-13. The purpose of these experiments is to define the changes in water chemistry that would result from temperature changes caused by emplacement of high-level nuclear waste in a repository in the Topopah Spring tuff. Experiments were conducted at 90°C and at 150°C in Teflon-lined reaction vessels. Results are given for four rock-to-water ratios at 90°C and for reaction times up to 72 days. Data for 150°C cover reaction times up to 64 days and four rock-to-water ratios. The composition of evaporite deposits contained in the pores of surface outcrop rock material used in these experiments is determined and for two of the data sets rock material was pretreated to remove this calishe-type material. The main conclusion that can be drawn from this work is that changes in the water chemistry due to heating of the rock-water system can be expected to be very minor. There is no significant source of anions (F^-, Cl^-, NO_3^-, or SO_4/sup =/) in the rock; solution anion compositions after reaction of pretreated rock with J-13 water differ very little from the starting compositions. The major changes in cations are an increase in silica to approximately the level of cristobalite solubility, supersaturation of aluminum followed by slow precipitation, and fairly rapid precipitation of Ca and Mg due to retrograde solubility of calcite. 7 references, 7 figures, 54 tables.

5605 (ZfI-Mitt—80, pp 40-41) **Isotope, thermo-barometric, and elemental geochemical investigations of the hydrothermal mineralization of fluorite from the southern part of the GDR.** Strauch, G.; Geisler, M.; Haase, G.; Stiehl, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Kaempf, H. (Akademie der Wissenschaften der DDR, Potsdam. Zentralinstitut fuer Physik der Erde); Thomas, R. (VEB Spurenmetalle, Freiberg (German Democratic Republic)). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5606 **Hugoniot data for pyrrhotite and the earth's core.** Brown, J.M.; Ahrens, T.J.; Shampine, D.L. (Geophysics Department, Texas A & M University). *Journal of Geophysical Research;* **89**: No. B7, 6041-6048(10 Jul 1984).

New shock wave Hugoniot data for pyrrhotite (Fe/sub 0.9/S) now describe the equation of state to nearly twofold compression at a maximum pressure of 274 GPa. A minor discontinuity on the Hugoniot between 100 and 150 GPa is interpreted as the melting transition. While not tightly constrained, the inferred melting point lies below lower-bound temperature estimates based on the Lindemann criterion. The highest-pressure Hugoniot data (representing the melted phase) are used to model the equation of state for liquid iron sulfide. A density for liquid pyrrhotite of 7.80 +- 0.20 Mg/m^3 under core-mantle boundary conditions (P = 135 GPa, T = 4000 K) is calculated. Assuming that sulfur is the primary alloying element in a predominately iron core, the present data are consistent with a homogeneous outer core containing 10 +- 4 wt % sulfur.

5607 **Rock properties and their effect on thermally induced displacements and stresses.** Chan, T.; Mood, M. (Atomic Energy of Canada, Ltd., Pinawa, Manitoba). *Journal of Energy Resources Technology;* **104**: No. 4, 384-388(Dec 1982).

A discussion is given of the importance of material properties in the finite-element calculations for thermally induced displacements and stresses resulting from a heating experiment in an in-situ granitic rock, at Stripa, Sweden. Comparisons are made between field measurements and finite element method calculations using (i) temperature independent, (ii) temperature dependent thermal and thermomechanical properties, and (iii) in-situ and laboratory measurements for Young's modulus. The calculations of rock displacements are influenced predominantly by the temperature dependence of the thermal expansion coefficient, whereas the dominant factor affecting predictions or rock stresses is the in-situ modulus.

5608 **Thermo-elastic responses associated with cavities and cracks in infinite media.** Advani, S.M.; Lee, J.K. (Dept. of Engineering Mechanics, The Ohio State Univ., Columbus, OH 43210). *Journal of Energy Resources Technology;* **104**: No. 4, 377-383(Dec 1982).

The increased adaption of classical thermo-elasticity solutions for rock mechanics applications has been evident in recent years. In this paper, specialized thermoelastic solutions for a triaxial ellipsoidal cavity with uniform surface temperature are presented and results for several limiting cases are deduced. For completeness and comparison, solutions and results for the related thermally stressed problem of a prolate spheroidal cavity are detailed. In addition, the applicability of the finite element technique and an appropriate failure criteria for in-situ thermo-mechanical problems is indicated.

5804 Geochemistry

REFER ALSO TO CITATION(S) 5804004374, 4982, 5066, 5067, 5585, 5602

5609 (ZfI-Mitt—80, pp 47-48) **Selective determination of the quantitative and isotope composition of sulphur mineral associations.** Ustinov, V.I.; Grinenko, V.A. (AN SSSR, Moscow. Inst. Geokhimii i Analiticheskoj Khimii). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5610 (ZfI-Mitt—80, pp 94) **Methodical investigations of the delta-D value determination of rocks and minerals.** Boettger, T. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5611 (ZfI-Mitt—80, pp 130) **Sample preparation of mineral inclusions for isotope geochemical investigations.** Nitzsche, H.M.; Strauch, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5612 (ZfI-Mitt—80, pp 25) **Isotope composition (O, H, C, S, and N) of the earth's mantle.** Hoefs, J. (Goettingen Univ. (Germany, F.R.). Geochemisches Inst.). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5613 (ZfI-Mitt—80, pp 63) **Isotope composition of crystal waters of carnallites and their initial solutions.** Schmiedl, H.D. (VEB Kombinat Kali, Sondershausen (German Democratic Republic)); Koch, K. (Ernst-Moritz-Arndt-Universitaet, Greifswald (German Democratic Republic). Sektion Geologische Wissenschaften); Boettger, T.; Stiehl, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung); Pilot, J. (Bergakademie Freiberg (German Democratic Republic). Sektion Geowissenschaften). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5614 (ZfI-Mitt—80, pp 99-101) **Nature on C isotope anomalies in carbonates of kimberlite tubes from the Siberian tableland.** Borshchevskij, Yu.A.; Medvedovskaya, N.I.; Stepanova, N.A. (AN SSSR, Moscow); Muehle, K.; Hendel, D. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5615 (ZfI-Mitt—80, pp 131-132) **Isotopic composition of carbonates and differences in depositional environment during the miocene lacustrine sedimentation in the Krusne Hory Graben.** Smejkal, V. (Cesky Geologicky Urad, Prague (Czechoslovakia)). Nov 1983. NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5616 (ZfI-Mitt—80, pp 139) **Model of the distribution of nitrogen isotopes between the gas phase and solid in thermal stress of organic substances.** Schuetze, H.; Lehmann, M. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5617 (ZfI-Mitt—80, pp 29) **Change of the isotope composition of oxygen in cherts and carbonates during diagenesis and metamorphism.** Gebhardt, O.; Schuetze, H. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Nov 1983. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780084. (CONF-8311182—Vol.1).

From 3. workshop on isotopes in nature; Leipzig, German D.R. (15 Nov 1983).

Published in summary form only.

5805 Oceanography

REFER ALSO TO CITATION(S) 5805004375

5618 **Wind-driven motion near a shelf-slope front.** Wang Ou, H. (Lamont-Doherty Geological Observatory, Columbus University, Palisades, NY 10964). *Journal of Physical Oceanography;* **14**: No. 6, 985-993(Jun 1984). Contract AC02-76EV02185.

A two-dimensional, two-layered frontal system is used to examine the wind-driven motion near a shelf-slope front. In the linear regime, the along-frontal current is characterized by barotropic perturbations. The front is dynamically passive and displaced according to purely kinematic constraints. The nonlinear solution shows that, even for a relatively small Rossby number, the frontal response to the oppositely directed along-frontal winds is highly asymmetric. When the wind is such that it forces surface water offshore, the model predicts ridging of the frontal interface, resembling some hydrographic observations. The model results suggest suggest that the topographic shoaling of the deep onshore flow causes the generaion of a cyclonic shear which, in a nonlinear regime, produces the observed ridging through geostropic balance. It is reasoned that the increased entrainment above the pycnocline ridge could cut off shelf water and result in its export to the slope water regime. On the other hand, the apparent rigidity of the front as the surface water moves shoreward suggests a relative ineffectiveness for the surface slope water to penetrate through the frontal zone and contribute to mass or property balances on the shelf.

5619 **Geostropic adjustment: A mechanism for frontogenesis.** Wang Ou, H. (Lamont-Doherty Geological Observatory, Columbia University, Palisades, NY 10964). *Journal of Physical Oceanography;* **14**: No. 6, 994-1000(Jun 1984). Contract AC02-76EV02185.

A simple two-dimensional model is used to determine the geostrophically adjusted state of an initially motionless fluid with lateral density gradient. It is an extension of the much studied two-layer models to the case when the initial stratification is continuous, and allows a more detailed examination of the density and current fields. In addition, the model has demonstrated that geostropic adjustment with its accompanying transverse circulation can produce regions of convergence and thus steepen the initial density gradient. In cases when the initial density transition is sharp enough, fronts, or density discontinuities, are formed at these convergence regions, along which the surface fluid particles drawn in from both sides of the fronts move into the interior. The density jump across the fronts is the greatest at the top and bottom surface and diminishes toward the interior where differential vertical motion during the adjustment can significantly level the isopycnals. One observed frontal surface south of Nantucket Shoals exhibits some qualitative features predicted by the model.

5620 **Circulation on the continental shelf of the southeastern United States. Part I. Subtidal response to wind and gulf stream forcing during winter.** Lee, T.N.; Jei Ho, W.; Kourafalou, V.; Wang, J.D. (Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149). *Journal of Physical Oceanography;* **14**: No. 6, 1001-1012(Jun 1984). Contract AS05-76EV05163.

Subtidal current and sea leavel response to wind and Gulf Stream forcing are investigated for the South Atlantic Bight shelf during winter conditions. Low-frequency flow variability in the outer shelf results primarily from wavelike meanders and eddies in

the Gulf Stream front that occur in a 2-day to 2-week period band. Current meter derived vertically integrated momentum balances indicated that these large amplitude flow events are in approximate geostropic balance with baroclinic pressure gradients induced by northward propagating Gulf Stream disturbances.

5621 **Circulation on the continental shelf of the southeastern United States. Part II. Model development and application to tidal flow.** Wang, J.D.; Kourafalou, V.; Lee, T.N. (Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149). *Journal of Physical Oceanography;* **14**: No. 6, 1013-1021(Jun 1984). Contract AS05-76EV05163.

An extensive amount of work has been carried out to characterize the flow on the shelf between Cape Canaveral and Cape Hatteras. Data show that the winter flow in this region is driven mainly by tides and wind, while significant Gulf Stream effects are observed only on the outer shelf. A vertically integrated two-dimensional model is adapted to the South Atlantic Bight shelf and applied to predict tidal and wind-driven currents under vertically well-mixed conditions that arc characteristic for the winter months (November to April).

5622 **Circulation on the continental shelf of the southeastern United States. Part II: Modeling the winter wind-driven flow.** Kourafalou, V.; Wang, J.D.; Lee, T.N. (Rosenthal School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149). *Journal of Physical Oceanography;* **14**: No. 6, 1022-1046(Jun 1984).

A vertically integrated two-dimensional method has been adapted for the study of the wind-driven flow on the South Atlantic Bight (SAB) shelf during the winter season. Wind data are used as an input to the model and current data are used to verify the model results.

64 PHYSICS. I.

REFER ALSO TO CITATION(S) 6400005565

5623 **(CSIR-SR-FIS—290) Annual report July 1981-June 1982.** (Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.). Oct 1982. 211p. NTIS (US Sales Only), PC A10/MF A01. File Number DE84703312.

A review is given on the activities of the National Physical Research Laboratory for the period July 1981 - June 1982. Research activities in the field of applied physics include: national measuring standards and metrology, optical sciences and physical acoustics. Research is also done in the earth and atmospheric sciences, including: atmospheric sciences, geochronology, geophysics and natural isotopes. In the fields of materials sciences and materials development and utilization research is being done in: materials characterization; ceramics, glass and phase studies; electrometallurgy; electronic materials; metal physics and physical metallurgy. A list of publications by the staff members is included in the review.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 6401005992

5624 **(AD-A—143680/7) Research studies on magnetohydrodynamic systems and modeling solar dynamical behavior. Final report July 1981-June 1983.** (Berkeley Research Associates, Inc., CA (USA)). Nov 1983. 135p. NTIS, PC A07/MF A01.

Original contains color plates: All DTIC and NTIS reproductions will be in black and white.

Research involving magnetohydrodynamic systems and solar dynamical behavior is presented. The reported research is divided into seven major sections: Section I. Laser Beam Matter Interactions, Section II. Ion Beam Matter Interactions, Section III. Energy Loss of Fast Particles to an Electron Plasma, Section IV. Solar Magnetic Flux Transport, Section V. Solar Magnetic Flux Emergence, Section VI. Coronal Bullets and Section VII. Solar Flares and Preflare Studies.

5625 **(AD-A—145026/1) Cosmic ray effects on microelectronics. Part 3. Propagation of cosmic rays in the atmosphere. Memorandum report.** Tsao, C.H.; Silberberg, R.; Adams, J.H. Jr.; Letaw, J.R.; Hulburt, E.O. (Naval Research Lab., Washington, DC (USA)). 9 Aug 1984. 74p. (NRL-MR—5402). NTIS, PC A04/MF A01.

See also Part 2, AD-A145 026.

Cosmic-ray nuclei that enter the atmosphere will subsequently breakup into lighter nuclei due to collisions with air particles. They also undergo a gradual loss of energy due to ionization. The fluxes and energy spectra of particles were calculated for several atmospheric depths and geomagnetic locations. The results of these radiation transport calculations are plotted as integral Linear Energy Transfer (LET) spectra showing the total number of particles that can contribute to energy lows in silicon above a given threshold value. The results can then be used to calculated the upset rate induced by cosmic ray nuclei for devices of known size and critical charge. Topics examined include: geomagnetic cutoff, soft upsets, and single event upsets.

5626 **(DOE/ER/40008—67) Global symmetry evolution in axion cosmologies.** Holman, R.; Kephart, T.W. (Florida Univ., Gainesville (USA). Dept. of Physics; Purdue Univ., Lafayette, IN (USA). Dept. of Physics). 1984. Contract AS05-81ER40008. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003235.

Cosmological constraints on invisible axion models require a mass scale far below the grand unification scale. Such a hierarchy can lead to an evolution of global symmetries accompanied by a complicated axion domain wall problem. We show that if this problem is solved at the highest mass scale in the theory, then it does not reoccur at lower mass scales. Two realistic models are discussed. 19 references.

5627 **(FNAL/C—84/90-A) Lepton-number violation in cosmology and astrophysics.** Kolb, E.W. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1984. Contract AC02-76CH03000. 11p. NTIS, PC A02. File Number DE85002190.

The cosmological and astrophysical implications of lepton number violation are discussed. The lepton number violation considered is due to the interactions of neutrinos with Nambu-Goldstone bosons.

5628 **(IC—83/184) Stochastic diffusion of dust grains by the interplanetary magnetic field.** Hassan, M.H.A.; Wallis, M.K. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700055.

The effects of the sectored Interplanetary Magnetic Field on charged dust grains orbiting around the sun under radiation pressure and Poynting-Robertson drag forces are examined for initially circular and non-inclined orbits. The distribution function of the charged grains satisfies a Fokker-Planck equation in which the sectored field is taken as a source of stochastic impulses. By adopting the integrals of the impulse-free motion as variable parameters, the Fokker-Planck equation can be properly treated as a diffusion equation. Analytic solutions of the resulting diffusion equation show that dust grains injected near the ecliptic plane are scattered strongly to high helio-latitudes. The scattering is more pronounced for small grains injected at large distances from the Sun.

5629 **(IC—83/205) Upper bound on entropy.** Khan, I.; Qadir, A. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700057.

An upper bound for entropy is derived. This bound is slightly stricter than that obtained by Bekenstein and is independent of black hole thermodynamics.

5630 **(KFKI—1984-10) Technical constraints for the GUT scale parameter.** Diosi, L.; Lukacs, B.; Keszthelyi, B.; Paal, G. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jan 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700061.

The influence of the grand unification scale on the thermal history of the early universe is discussed. Above M approx.= 6.8×10^{15} GeV the irreversibilities seem to be too strong to ignore, and the usual calculations lose their validity. 19 refs.

5631 **(KFKI—1984-34) Does the Newton's world model revive.** Meszaros, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700019.

Newton's world model may have a physical meaning if the gravitation has small non-zero mass and if the observable part of the universe is the interior of a giant finite body. Both possibilities are allowed theoretically. 8 refs.

5632 **(KFKI—1984-41) Role of electric fields in the cometary environment.** Cravens, T.E.; Gombosi, T.I.; Gribov, B.E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 47p. (CONF-8309283—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700056.

From International theoretical workshop on comets; Budapest, Hungary (1 Sep 1983).

Polarization electric fields in the cometary environment are shown to influence both the cometary plasma and the fine cometary dust. The role of the ambipolar electric field on the dynamics and thermodymamics of the cometary ionosphere is discussed. It is shown that this field decelerates and cools the plasma in the outer cometary ionosphere, and shock waves can develop in the plasma flow due to this deceleration. The consequences of electrostatic change of the cometary dust are considered. It is shown that while the consequences are minimal within the cometary ionosphere, they are substantial outside. The convectional electric field in the inflowing solar wind (both outside and inside the outer shock), as well as the Coulomb drag of this plasma on the charged dust, affect significantly the dynamics of the lower end of the dust mass spectrum. 7 refs.; 11 figs.

5633 **(PB—84-215078) Solar-geophysical data number 476, April 1984. Part 2 (comprehensive reports). Data for October 1983, June 1981, and miscellanea.** (National Geophysical Data Center, Boulder, CO (USA)). Apr 1984. 124p. (SGD—476-PT-2). NTIS, PC A06/MF A01.

See also PB84-215060, and PB84-201516. Library of Congress catalog card No. 79-640375.

Contents: Data for October 1983--(Solar radio bursts at fixed frequencies, Mass ejections from the sun); Data for June 1981--Solar flares June 1981; Miscellaneous data--(Active regions Meudon 29 July - 21 September 1983, Synoptic solar maps 29 July 21 September 1983, Interplanetary solar particles and plasma IMP 8 data for 1982, Solar proton events 1976-1984, 1982 solar flares = or > 1B and with plage variations).

5634 **(RAL—84-004) Abundance of interstellar chlorine in the galaxy.** Harris, A.W.; Bromage, G.E. (Rutherford Appleton Lab., Chilton (UK)). Jan 1984. 30p. (SA—83-20). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700059.

To be published in Mon. Not. R. Astr. Soc.

Newly derived equivalent widths from IUE spectra are combined with published Copernicus equivalent widths, to estimate interstellar abundances of chlorine for over 40 Galactic sightlines. It is found that the relative chlorine abundance shows no noticeable trend with either distance from the Galactic plane of the background star, or with its colour excess. However, the abundance does show a marked decrease with increasing mean line-of-sight hydrogen space density n-bar(H) according to the approximate relation a(Cl) approx.= 4.9 - 0.3 log [n-bar(H), cm^{-3}]. For low space densities, the chlorine abundance appears to approach the solar value of approx. 5.5. Chlorine seems to adhere to dust grains rather more readily than was previously thought. In addition, a clear linear relation is found between the ratio of Cl II to Cl I column densities and that of H I to H_2 supporting simple models of interstellar chlorine chemistry.

5635 **(RAL—84-005) Ultraviolet, optical and infra-red observations of the Wolf-Rayet contact-eclipsing binary CQ Cephei.** Stickland, D.J.; Budding, E.; Howarth, I.D.; Willis, A.J.; Jameson, R.; Sherrington, M.R.; Bromage, G.E.; Burton, W.M. (Rutherford Appleton Lab., Chilton (UK)). Jan 1984. 85p. (SA—83-12). NTIS (US Sales Only), PC A05/MF A01. File Number DE85700058.

Accepted for publication in Astronomy and Astrophysics.

The present study on wolf-rayet contact-eclipsing binary CQ Cephei is an attempt to combine the best observational previous results with an extensive set of UV data from the IUE Satellite and with new IR photometric data. The orbital variations of the CQ Cep system are investigated as well as the secondary component. The early studies of CQ Cep are reviewed, and the observations used in the present analysis described. Continuum energy distribution, interstellar extinction, photometric variability, light curves, time dependence of the emission and absorption line spectra and models for the CQ Cept system are discussed.

5636 **(UWThPh—84-32) Supercharge and background perturbations of multi-black hole systems.** Aichelburg, P.C.; Embacher, F. (Vienna Univ. (Austria)). 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700024.

We consider spin-3/2 fields on backgrounds of several extreme black holes. The existance of killing spinors on these backgrounds allows one to assign, although not uniquely, supercharge parameters associated with the Rarita-Schwinger field to the individual black holes. For regular static spin-3/2 fields the values of these supercharges are strongly constrained by the background configuration. Furthermore, we establish an integral relation between Rarita-Schwinger fields and first order perturbations of the background: The supercharge can be connected to the first order changes of the masses and the electric charges. Special configuration that admit only zero total supercharge are given.

5637 **Implications of a class of grand unified theories for large-scale structure in the universe.** Shafi, Q.; Stecker, F.W. (Bartol Research Foundation of the Franklin Institute, University of Delaware, Newark, Delaware 19716). *Physical Review Letters;* **53**: No. 13, 1292-1295(24 Sep 1984).

We consider a class of grand unified theories in which cosmologically significant axion and neutrino energy densities arise naturally. To obtain large-scale structure we consider (1) an inflationary scenario, (2) inflation followed by string production, and (3) a noninflationary scenario with density fluctuations caused solely by strings. We show that inflation may be compatible with the recent observational indications that $\Omega < 1$ on the scale of superclusters, particularly if strings are present.

5638 **Large-scale anisotropy of the microwave background and the amplitude of energy density fluctuations in the early universe.** Abbott, L.F.; Wise, M.B. (Physics Department, Brandeis University). *Astrophysical Journal, Letters to the Editor;* **282**: No. 2, L47-L50(15 Jul 1984).

The spectrum of energy density fluctuations predicted by the inflationary cosmology is used to compute multipole moments of the microwave background temperature and the probability distributions for these moments. Comparison with the observed dipole moment gives a 90% confidence level upper bound of 3.4×10^{-6} on the amplitude of these fluctuations when they cross the horizon.

5639 **Massive neutrinos and the pancake theory of galaxy formation.** Schaeffer, R.; Silk, J. (Service de Physique Theorique CEN-SACLAY, 91191 Gif-sur-Yvette, France). *Astrophysical Journal, Letters to the Editor;* **281**: No. 1, L13-L15(1 Jun 1984).

Three problems encountered by the pancake theory of galaxy formation in a massive neutrino-dominated universe are discussed. A nonlinear model for pancakes is shown to reconcile the data with the predicted coherence length and velocity field, and

minimal predictions are given of the contribution from the large-scale matter distribution.

5640 **Monopoles in 1983.** Preskill, J. (California Inst. of Technology, Pasadena, CA). pp 663-685 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

This chapter reviews some of the recent theoretical developments concerning the implications of magnetic monopoles in cosmology, astrophysics, and particle physics. Topics considered include Kaluza-Klein monopoles, stable multimonopoles, the demise of global color, and monopoles and fermions. The existence of magnetic monopoles is a general consequence of grand unification of the fundamental interactions. The use of the chiral soliton approach to obtain some qualitative information about the velocity dependence and multiplicities in catalyzed nucleon decay is suggested. It is concluded that areas deserving further investigation are monopole production in the inflationary cosmology, the properties of Kaluza-Klein monopoles and multimonopole bound states, and the rates of processes catalyzed by monopoles.

6402 Atmospheric Physics

5641 **(N—84-28131) Proceedings of a Workshop on Research Needs in Heterogeneous Tropospheric Chemistry.** (National Aeronautics and Space Administration, Washington, DC (USA)). 1983. 83p. (NASA-CP—2320; L—15801). NTIS, PC A05/MF A01.

The role of heterogeneous reactions and processes in the troposphere is critically assessed. The results of this assessment, including identification and prioritization of a number of important and scientifically tractable processes, as well as recommendations of ways in which they can be incorporated into the existing NASA tropospheric chemistry program are presented. Also presented is a detailed summary of the considerations that led to the group's recommendations.

5642 **Simultaneous observation of HF-enhanced plasma waves and HF-wave self-focusing.** Frey, A.; Duncan, L.M. (Max-Planck-Institut fuer Aeronomie, D-3411 Katlenburg-Lindau, F.R. Germany). *Geophysical Research Letters;* **11**: No. 7, 677-680(Jul 1984).

Intense HF-radiowaves of the ordinary mode transmitted from the ground enhance plasma waves near the reflection height. These have been extensively studied in the past by the use of Incoherent-Scatter-Radars. Intense HF-radiowaves propagating in the ionosphere also produce electron density irregularities with scale sizes much larger than the HF wavelength of ~60 m. These have been observed by radio star intensity scintillations. For the past 2 years a new method was used at Arecibo, P.R. which allows radar- and scintillation-measurements at 430 MHz to be performed simultaneously along the same line of sight. The scale sizes deduced from the scintillation measurements are shorter than the scale sizes observed with the radar and are inconsistent with the HF-power density thresholds predicted by existing theories.

5643 **Density spectra as a function of altitude in an ionospheric barium release.** Lebeda, C.; Gary, S.P.; Pongratz, M.B. (EG & G, Inc.). *Geophysical Research Letters;* **11**: No. 6, 591-594(Jun 1984).

Plasma column density fluctuation spectra observed from the Buaro ionospheric barium release have been analyzed as a function of altitude over the range 285 km to 345 km. The wavenumber spectra become steeper with increasing altitude, the first time this has been shown in any ionospheric injection experiment. The source of these steepened spectra is argued to be wave-particle scattering due to the universal density drift instability.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 6403005088, 5749

5644 **(AD-A—143423/2) Relativistic calculations and measurements of energies, Auger rates, and lifetimes. Final technical report 15 June 1983-14 February 1984.** Crasemann, B. (Oregon Univ., Eugene (USA). Dept. of Physics). 14 Feb 1984. 15p. NTIS, PC A02/MF A01.

See also AD-A130 094.

This project is devoted to the study of the structure and dynamics of deep hole states in atoms and of few-electron systems. During the reporting period, work has been completed on the gauge dependence of atomic inner-shell transition rates, M x-ray emission rates in Dirac-Fock approximation, Auger and radiative deexcitation in P4+ ions, inelastic x-ray scattering cross sections of neon, on two book-length monographs on inner-shell processes, and on two reviews of atomic physics with synchrotron radiation. Threshold excitation phenomena in deep inner shells are being explored through gas-phase electron spectrometry with synchrotron radiation, and investigations of the resonant Auger Raman effect and post-collision interaction are being pursued.

5645 **(BONN-HE—84-3) Optimised mean fields for atoms III.** Dietz, K.; Weymans, G. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jan 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750006.

Relativistic and non-relativistic g-Hartree calculations of correlation energies for first row atoms are presented. A discussion of the connection of various mean field approaches is given.

5646 **(CONF-841117—19) Correlated two electron effects in collisions of multiply charged Au ions with He.** Datz, S.; Bottcher, C.; Andersen, L.H.; Hvelplund, P.; Knudsen, H. (Oak Ridge National Lab., TN (USA); Aarhus Univ. (Denmark). Inst. of Physics). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003064.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

We have studied the fate of electrons released in collisions between highly charged Au/sup q+/ ions (20 MeV) and He atoms and find that the large transfer ionization (TI) cross section observed can be accounted for by transfer of two electrons to a highly correlated state on the Au projectile followed by the loss of one electron to the continuum. Autoionization lines are also observed, but they are attributable to electron transfer accompanied by core excitation (TE).

5647 **(CONF-841117—20) Time dependent Hartree-Fock theory of ion-atom collisions: application to F^{9+} + Ne.** Bottcher, C. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003083.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Atomic collisions at intermediate energies are formulated in terms of a time dependent self-consistent field. Numerical problems which arise in applying the formalism to heavy ions and atoms are discussed. Results are presented on charge capture and ionization in F^{9+} + Ne collisions.

5648 **(DOE/ER/13055—T1) Theoretical investigation of electron-positive ion/atom interactions. Final report, April 1, 1983-June 30, 1984.** Msezane, A.Z. (Morehouse Coll., Atlanta, GA (USA)). 1984. Contract AS05-83ER13055. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002833.

Theoretical investigations of electron-positive ion atom interactions are described. Studies were carried out using accurate CI wave functions in the close-coupling approximation. The purpose was to identify and calculate dominant physical mechanisms which underlie the processes of electron impact excitation and ionization, and to produce accurate total and differential cross sections to guide experimental measurements. Detailed numerical analysis was

pursued to investigate the contributions of the physical processes of inner-shell excitation-autoionization, and inner-shell resonant-excitation-double autoionization of K-like Ti^{+3}, important in CTR plasmas. Effects of wave functions upon photoionization cross sections of excited atomic states were also studied. Of great interest was the photoionization of d-subshells of excited atoms with predicted dipole zeroes in the matrix elements. The purpose was to produce accurate partial and total photoionization cross sections and angular asymmetry parameters to direct measurements in the search for the predicted multiminima. The importance of correlations was investigated in the photoionization of excited Ag 5d, Cu 4d and 5d states.

5649 **(DOE/EV/10373—T1) Extended ion energetics data base for mass spectrometric characterization of energy related pollutants. Final report.** Parr, A.C. (National Bureau of Standards, Washington, DC (USA). Center for Radiation Research). 1983. Contract AT01-80EV10373. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85003174.

This project funded research at NBS from September, 1982 until November, 1983 and represented a continuation of an effort in precision ion thermochemistry measurements and calculations. The effort was divided into two main areas: laboratory effort using threshold photoelectron-photoion coincidence spectroscopy and a theoretical effort in ion energetics estimation schemes.

5650 **(JINR—R-3-83-820) Chemical shifts of ^{235}U and ^{234}U neutron resonances.** Zajdel', K.; Zeeliger, D.; Majster, A.; Chammer, R.; Mittag, Z.; Pabst, D.; Pikel'ner, L.B.; Pil'ts, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700090.

Transmission spectra were measured with time-of-flight technique at the Dubna pulsed reactor for samples of metallic U, UO_2, U_3O_8, and UO_3 enriched in ^{235}U, and were compared in the regions of nine low energetic resonances to observe chemically induced shifts. After elimination of contributions caused by different Doppler broadening the shifts are interpreted in terms of change of the mean-square radius of the nucleus in the neutron capture. The $< r^2 >$ of the compound nucleus states shows in the average a weak diminution compared with the ground state value, and a correlation with the fission width. 21 refs.; 4 figs.; 4 tabs.

5651 **(PB—84-225325) Neutron induced atomic excitation and neutron moderation. Final report.** Bowman, C.D.; Johnson, R.G. (National Bureau of Standards, Washington, DC (USA)). 1983. 3p. Pub. in Proceedings of Conf. Nuclear Data Science Technology, Antwerp, Belgium, September 6-10, 1982, p971-973 1983.

Sponsored in part by European Physical Society, Geneva (Switzerland), Antwerp Univ., Wilrijk (Belgium), and International Union of Pure and Applied Physics, London (England).

The excitation of electrons in atoms due to neutron-nucleus scattering has been examined. The cross section for neutron scattering with an accompanying excitation of a particular electron has been derived. In addition, a procedure for estimating the probability of any electron excitation in neutron scattering has been formulated. Using these probability estimates the effect of electronic excitations in neutron moderation problems has been connected to a small fractional increase (of the order of .0001) in the average logarithmic energy decrement. In special cases this small increase may lead to effects of about 1%.

5652 **(PNL-SA—12212) Inner shell contribution to multiple ionization in ion-atom collisions.** DuBois, R.D.; Toburen, L.H.; Manson, S.T. (Pacific Northwest Lab., Richland, WA (USA); Georgia State Univ., Atlanta (USA). Dept. of Physics and Astronomy). Aug 1984. Contract AC06-76RL01830. 15p. (CONF-840829—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003107.

From International conference on x-ray and inner-shell processes in atoms, molecules and solids; Leipzig, Germany D.R. (20 Aug 1984).

Energetic proton impact ionization data for atomic targets is useful in testing our theoretical understanding of atomic collisions. In general, our understanding of bare projectile impact leading to single target ionization is quite good. Multiple ionization mechanisms are, however, less well understood. In certain cases, multiple ionization can account for as much as 50% of the total ionization cross section and thus cannot be neglected in modeling the collision process. Multiple target ionization can occur in a variety of ways. In order to fully analyze the collisional process, cross sections for each of these ionization pathways are necessary but, in general, are unavailable. However, in certain cases combining various experimental and theoretical data allows us to obtain some information about channels heretofore unmeasured. Our purpose here is to outline a procedure that we are currently using to unravel the complex multiple ionization process. In some cases, cross sections for specific ionization pathways can be obtained while in others only information about total contributions of specific ionization channels is available.

5653 **(RAL—84-027) Studies of muonium-substituted molecules in 2-propanone and in aqueous solutions of 2-propanone.** Cox, S.F.J.; Renzi, R. De; Scott, C.A.; Hill, A.; Symons, M.C.R.; Bucci, C.; Vecli, A. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700035.

The paper deals with muonium substituted molecules, which are formed when positive muons are implanted in pure 2-propanone and in binary aqueous systems; and are studied by the muon spin rotation technique. Studies of muonium substituted molecules are discussed under five topic headings: hyperfine interaction, influence of the solvent, radical formation, diamagnetic fraction and line widths.

5654 **(TRI-PP—83-51) Charge exchange of muons in gases: I. Kinetic equations.** Turner, R.E. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700036.

Submitted to Physical Review A.

Kinetic equations for the spin density operators of the diamagnetic and paramagnetic states of the positive muon are obtained for the description of the slowing-down process encountered when high energy muons thermalize in a single component gas. The motion of this two species system is generated by the Liouville superoperators associated with the diamagnetic and paramagnetic spin Hamiltonians and by time-dependent rate superoperators which depict the probabilities per collision that an electron is captured or lost. These rates are translational averages of the appropriate Boltzmann collision operators. That is, they are momentum and position integrals of the product of either the electron capture or loss total cross section with the single particle translational density operators for the muon (or muonium) and a gas particle. These rates are time dependent because the muon (or muonium) translational density operator is time dependent. The initial amplitudes and phases of the observed thermal spin polarization in μSR experiments are then obtained in terms of the spin density operators emerging from the stopping regime.

5655 **(TRI-PP—83-52) Charge exchange of muons in gases. Experimental implications from rate theory.** Turner, R.E.; Senba, M. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 4p. (CONF-830455—14). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700037.

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

The effects of the charge exchange process on muon spin dyramics have been investigated using a density operator formalism with special interest placed upon the diamagnetic muon and paramagnetic muonium signals observed after thermalization. In the charge exchange region the dynamics of the spin density operator is assumed to be determined by the muonium hyperfine interaction and by electron capture and loss processes for muons. Analytical expressions are obtained for the amplitudes and phases of the diamagnetic muon and paramagnetic muonium signals as a function of the duration of the charge exchange region, tsub(c), which is inversely proportional to the number density of the moderating gas. The theoretical signals exhibit three features which have, as yet, to be experimentally observed, namely: i) that the amplitudes associated with the muonium Larmor frequency and with the hyperfine

frequency are not, in general, equal, ii) that all the amplitudes are, in general, damped oscillatory functions of tsub(c) (temperature/pressure) and iii) that phase jumps occur when an amplitude decreases to zero and then increases with falling pressure. Fits to the experimental argon data are discussed in light of the above points.

5656 **(TRI-PP—83-53) Muonium formation and the 'missing fraction' in vapors.** Fleming, D.G.; Arseneau, D.J.; Garner, D.M.; Senba, M.; Mikula, R.J. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 17p. (CONF-830455—15). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700038.

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

The vapor phase fractional polarizations of positive muons thermalizing as the muonium atom (Psub(M)) and in diamagnetic environments (Psub(D)) has been measured in H_2O, CH_3OH, C_6H_{14}, C_6H_{12}, CCl_4, $CHCl_3$, CH_2Cl_2 and TMS, in order to compare with the corresponding fractions measured in the condensed phases. There is a marked contrast in every case, with the vapor phase results being largely understandable in terms of a charge exchange/hot atom model. Unlike the situation in the corresponding liquids, there is no permanent lost fraction in the vapor phase in the limit of even moderately high pressures (approximately 1 atm); at lower pressures, depolarization is due to hyperfine mixing and is believed to be well understood. For vapor phase CH_3OH, C_6H_{14}, C_6H_{12}, and TMS the relative fractions are found to be pressure dependent, suggesting the importance of termolecular hot atom (or ion) reactions in the slowing-down process. For vapor phase H_2O and the chloromethanes, the relative fractions are pressure independent. For CCl_4, Psub(M) = Psub(D) approximately 0.5 in the vapor phase vs. Psub(D) = 1.0 in the liquid phase; fast thermal reactions of Mu likely contribute significantly to this difference in the liquid phase. For H_2O, Psub(M) approximately 0.9 and Psub(D) approximately 0.1 in the vapor phase vs. Psub(D) approximately 0.6 and Psub(M) approximately 0.2 in the liquid phase. Water appears to be the one unequivocal case where the basic charge exchange/hot atom model is inappropriate in the condensed phase, suggesting, therefore, that radiation-induced 'spur' effects play a major role.

5657 **(TRI-PP—83-54) Formation and reactivity of the μi molecular ion $NeMu^+$.** Fleming, D.G.; Mikula, R.J.; Senba, M.; Garner, D.M.; Arseneau, D.J. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700039.

Submitted to Chemical Physics.

Evidence for the formation and reactivity of the positive muon molecular ion $NeMu^+$ at room temperature in a low pressure Ne moderator to which trace amounts of Xe, CH_4, NH_3 or He have been added, is reported. A two component relaxation of the diamagnetic muon spin rotation (μSR) signal is seen upon the addition of trace amounts of Xe to Ne; a fast relaxing component with bimolecular rate constant (3.6+-0.6) x 10^{-10} cc atom $^{-1}$ s^{-1} is thought to be due to thermal muonium formation in a charge exchange process while the other slow relaxing component is attributed to a muon transfer reaction, as in proton transfer studies. With CH_4 or NH_3 added to Ne there is, at most, only a very slow relaxation seen, even though thermal muonium formation is expected, in analogy with Xe. These latter results may be due to very fast, possibly tunneling-assisted, muon transfer reactions, the first time that such processes have been at all characterized.

5658 **(TRI-PP—83-58) Muon spin rotation studies involving muonium at high pH.** Ng, B.W.; Stadlbauer, J.M.; Walker, D.C. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700040.

Submitted to Journal of Physical Chemistry.

The muon spin rotation method was used to determine the muon yields in concentrated KOH solutions and to evaluate Arrhenius parameters for the reaction of muonium with hydroxyl ions in dilute aqueous solutions. This latter reaction is relatively slow due to a substantial activation energy, yet there is no kinetic isotope effect at room temperature. The kinetics are well represented by the relationship log ksub(M) = 14.38 - 2100(+-260)/T. The observed enhancement of the diamagentic muon yield (Psub(D)) from 0.62 to 0.79 as the (KOH) was increased from 0 to 20 M can be accounted for in terms of a 'hot-model' mechanism, by allowing Ksub(M) (or the hot fraction) to vary somewhat. The failure of Psub(D) to reach 1.0 in such concentrated OH^- solutions shows that the muons do not all emerge from the epithermal processes of the track as free μ^+ ions.

5659 **(TRI-PP—83-59) Recent results in muonium solution kinetics.** Jean, Y.C.; Ito, Y.; Stadlbauer, J.M.; Ng, B.W.; Walker, D.C. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 4p. (CONF-830455—16). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700041.

From Yamada conference on muon spin rotation and associated problems; Shimoda, Japan (18 Apr 1983).

Using muonium spin rotation (MSR) techniques the aqueous solution kinetics of several muonium addition reactions and spin conversion interactions have been studied. The addition reactions show both diffusion and activation-controlled reaction rates with isotope effects between 1 and 3 for diffusion-control and between 7 and 31 for activation-control reactions. Barrier energies are typically approximately 15 kJ/mole and approximately 30 kJ/mole, respectively, for these processes in water. Spin-conversion interactions involving Ni^{+2}(aq) and Ni(cyclam)$^{+2}$ complexes showed that spin-conversion of 'triplet' Mu by a paramagnetic solute occurs at or near the diffusion-controlled limit while the chemical reaction with the diamagnetic configuration of Ni(cyclam)$^{+2}$ occurred some 100 times slower at ksub(M) < $5x10^{18}$ $M^{-1}s^{-1}$.

5660 **(TRI-PP—83-60) Electron scavenger effects on diamagnetic muon fractions in C-hexane.** Miyake, Y.; Tabata, Y.; Ito, Y.; Ng, B.W.; Stadlbauer, J.M.; Walker, D.C. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700042.

In order to clarify the mechanism of Mu formation, effects of scavengers on Psub(D) in cyclohexane were examined and compared with the experimental yield of Ps formation for the same solutions. These results suggest that Mu formation is different from Ps formation, and does not agree with the simple spur reaction model.

5661 **(TRI-PP—84-51) Atomic capture ratios for muons in oxides.** Stanislaus, S.; Entezami, F.; Bagheri, A.; Measday, D.F.; Garner, D. (British Columbia Univ., Vancouver (Canada)). Jul 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900295.

Using the lifetime technique, atomic capture ratios of negative muons have been measured in 41 oxides. The results, though somewhat different from the earlier TRIUMF findings, are consistent with the mesic x-ray measurements. It has been noticed that the atomic capture ratios have an approximately linear dependence on density, whereas the Z-dependence is periodic. 49 references, 4 figures, 1 table.

5662 **(TRI-PP—84-52) Atomic capture and density.** Stanislaus, S.; Entezami, F.; Measday, D.F. (British Columbia Univ., Vancouver (Canada). Dept. of Physics). Jul 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900294.

Including a density dependence, as well as a Z-dependence, an empirical expression was formulated for atomic capture ratios of negative muons in oxides, chlorides and fluorides, using a chi-squared minimization method. In every case the reduced chi-square produced by this expression is lower than that obtained from any of the present atomic capture models.

5663 **Shock compression of liquid helium to 56 GPa (560 kbar).** Nellis, W.J.; Holmes, N.C.; Mitchell, A.C.; Trainor, R.J.; Governo, G.K.; Ross, M.; Young, D.A. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **53**: No. 13, 1248-1251(24 Sep 1984). Contract W-7405-ENG-48.

The first shock-compression experiments on liquid helium are reported. With a two-stage light-gas gun, liquid He at 4.3 K and

1 atm was shocked to 16 GPa and 12 000 K and double shocked to 56 GPa and 21 000 K. Liquid perturbation theory has been used to determine an effective interatomic potential from which the equation of state of He can be obtained over a wide range of densities and temperatures.

5664 **Progress in numerical calculations of ion-atom collisions.** Reading, J.F.; Ford, A.L.; Smith, J.S.; Alexander, J. (Texas A and M Univ., College Station (USA). Dept. of Physics); Becker, R.L. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **232**: No. 2, 266-270(Jul 1984). (CONF-8308173—).

From 3. workshop on inner shell ionization by light ions; Linz, Austria (4 Aug 1983).

Also published as report CONF-830390–2.

A new method of accurately computing ionization cross sections at low energies is described. Preliminary investigations indicate that we have developed a useful tool for sorting out the inaccuracies in the Brandt prescriptions for correcting the first Born approximation cross section.

5665 **Roles of Pauli correlations, channel couplings, and shake-off in ion-induced KLsup(V) and K^2Lsup(V) multiple-vacancy production.** Becker, R.L. (Oak Ridge National Lab., TN (USA)); Ford, A.L.; Reading, J.F. (Texas A and M Univ., College Station (USA)). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **232**: No. 2, 271-278(Jul 1984). (CONF-8308173—). Contract W-7405-ENG-26.

From 3. workshop on inner shell ionization by light ions; Linz, Austria (4 Aug 1983).

Cross sections for target K-plus-L-shell multiple-vacancy production by ions can be inferred from experimental intensities. The theory of Ksup(n) Lsup(v) multiple-vacancy distributions has been generalized from the single-particle model (the statistically independent electron approximation) to the independent Fermi particle model. The Pauli correlations (electron exchange terms) are found to nearly cancel in many cases because of a tendency toward random phases.

5666 **Beam-foil convoy electron distributions as a function of energy and angle of emission.** Focke, P.; Nemirovsky, I.B.; Gonzales Lepera, E.; Meckbach, W. (Comision Nacional de Energia Atomica, San Carlos de Bariloche (Argentina). Centro Atomico Bariloche; Universidad Nacional de Cuyo, San Carlos de Bariloche (Argentina). Inst. Balseiro); Sellin, I.A. (Oak Ridge National Lab., TN (USA)); Groeneveld, K.O. (Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 235-240(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Three dimensional convoy electron distribution, given by electron counts versus energy and angle, are measured for 105, 190 and 270 keV hydrogen projectiles traversing carbon foils. The results are compared with three dimensional cusps obtained recently for H^0 and H^+ interacting with He gas, that is for electron loss (ELC) and capture (ECC) into the continuum. It is confirmed that beam-foil convoy electron cusps are more similar to ELC than to ECC cusps. However, contour lines, represented in velocity space and taken at different levels on the peak, do not show a particular structure such as that seen in ELC and ECC.

5667 **Approximation for the surface backscattering yield from atomic row with correlated thermal vibrations.** Jackson, D.P. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Barrett, J.H. (Oak Ridge National Lab., TN (USA). Solid State Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 318-321(Mar 1984). (CONF-830780—). Contract W-7405-ENG-26.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

An approximation method is given which permits rapid calculation of the surface backscattering yield from an atomic row with correlated thermal vibrations. The method has been tested by comparison with computer simulations for low index directions in Pt, Au, Mo and Si for He^+ beam energies between 0.5 and 2.0 MeV over the temperature range 50-500 K. Agreement was found to be good in those cases where shadow cone scaling of the yields is valid.

5668 **Attractive interaction between an atom and a surface.** Manson, J.R. (Clemson Univ., SC (USA). Dept. of Physics); Ritchie, R.H. (Oak Ridge National Lab., TN (USA). Health and Safety Research Div.; Tennessee Univ., Knoxville (USA). Dept. of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 422-426(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Using a general self-energy formalism, we examine the interaction between an atom and a surface. Considered in detail are deviations from the Van der Waals force due to recoil and finite velocity of the particle. Calculations for positronium near a metal surface show that for such systems, recoil and velocity effects are significant even at very low energies. We also examine the mechanisms for energy exchange with the surface and calculations show that single quantum events do not always dominate the exchange rates.

5669 **Neutralization of energetic He ions scattered from clean "2x1" Si(100).** Haight, R. (Bell Labs., Murray Hill, NJ (USA); State Univ. of New York, Albany (USA)); Feldman, L.C.; Buck, T.M. (Bell Labs., Murray Hill, NJ (USA)); Gibson, W.M. (State Univ. of New York, Albany (USA)). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 501-504(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

We report on a comprehensive study of the neutralization of 75-180 keV He ions scattered from the UHV cleaned '2x1' Si(100) surface using sensitive channeling techniques. It is shown that ions are neutralized exclusively at the solid surface on the ion's outward path. Angular and depth dependence results are discussed.

5670 **Inner shell vacancies in sputtered atoms.** Thomas, E.W.; Whaley, R. (Georgia Inst. of Tech., Atlanta (USA). School of Physics). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 516-519(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Impact of heavy ions (Ne^+, Ar^+) on surfaces of Mg, Al and Si are known to produce Auger spectra characteristic of 2p vacancies in the target species. Excitation is largely by recoil collisions in the target matrix leading to curve crossing events. A detailed modelling of the observed spectrum is performed which accounts for all significant features. An underlying continuum is shown to be due to secondary electrons and to decay of atoms in the matrix. An apparent discrepancy between the high energy edge of electron and ion induced spectra is due to a hitherto unidentified line in the ion induced spectrum. Dominant line features of the ion-induced spectra are due to sputtered neutral atoms with a single L-shell vacancy. Electron conficurations and measured excitation energies are for Mg ($2p^5 3s^2 3p$) 50.6 eV, for Al ($2p^5 3s^2 3p^2$) 73.8 eV and for Si ($2p^5 3s^2 3p^3$) 101.1 eV.

5671 **Track damage and erosion of insulators by ion-induced electronic processes.** Tombrello, T.A. (California Inst. of Tech., Pasadena (USA). Div. of Physics, Mathematics, and Astronomy). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 555-563(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Track damage and the associated ejection of atoms and molecules from insulators, which occur as a result of ion-induced electronic excitation, are of interest both in their own right and because of the mechanisms through which the energy in the excited electrons is transformed into atomic motion. In this paper an overview is given of the phenomena that are observed. We show that there is a remarkable similarity between the damage profile along the ion's track in the solid and the yield of ejected atoms at the energy that corresponds to each point on the track. It is also seen that the density of extended defects (or, correspondingly, the ejected particle yield) appears to have an 'universal' form that is weakly dependent on the type of material. In the model presented this is a consequence of the inner-shell ionization of light elements in the solid by the incident ion, the resulting Auger decay produces an intense ionization spike that locally triggers the track formation/erosion process. This model allows the estimation of erosion yields/damage profiles for different ions and materials. 40 refs.

5672 **(UCRL-Trans—11991) Electron beam evaporation source with integrated rate control.** Wulff, G. Translated from *Vakuum-Technik ;* **26**: No. 2, 39-48([nd]). Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016065. DE84016065

A certain portion of the vapour atoms produced in the electron beam evaporation source is ionized by the electron beam and, by means of the deflecting magnetic field around the beam source, projected to a measuring probe. Because of an ion current in the mA-range and a life time of 100 to 1000 times the life of a normal film thickness monitor (oscillating quartz), this system is perfectly suited for thin film manufacturers where a reproducibility of less than 5% for deposition rate and film thickness is required. This accuracy can be realized for all electrically conductive and non-conductive materials.

5673 **(UCRL-Trans—11990) Al/Si metallization by rate controlled dual EB-gun evaporation.** Hegner, F.; Feuerstein, A. Translated from *Vakuum-Technik ;* **28**: No. 1, 3-11([nd]). Contract W-7405-ENG-48. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE84016067. DE84016067

An industrial process for aluminium-silicon metallization using two rate controlled electron beam evaporators will be described. The two sources are operated simultaneously. The silicon source rate control is achieved by the direct measurement of the deposition rate with a quartz crystal monitor. The aluminium deposition rate is controlled by an ion probe system. The ion current measurement for the control of the evaporator is discussed and a typical process sequence is described. The reproducibility of the silicon content in the aluminium-silicon layers is better than 20%. An uniform distribution of the aluminium and silicon content through the total layer is demonstrated by SIMS analysis. Optimization of the uniformity and the step coverage of the deposited films is achieved by a special planetary system in combination with off-axis located sources. Thickness uniformity is better than 2% over the planetary fixture (75 wafers with 3 inch diameter). Step coverage of 60° and 90° oxide steps for cold as well as for hot substrates is excellent; with substrate heating (300°C) even overhanging steps and steps with a contraction at the base are covered without microcracks or tunneling. Radiation damage tests demonstrate that e-gun induced radiation damage in MOS-devices can be completely annealed at moderate temperatures.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 6404205019, 5020

5674 (JINR—D-3,4-82-704, pp 503-513) **Neutron scattering in helium II.** Blagoveshchenskij, N.M.; Parfenov, V.A.; Puchkov, A.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.); Kozlov, Zh.A. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

The study on the correlation of the temperature dependence of the bose condensate and superfluid component densities in helium 2 from the neutron experiment data is reviewed. The data analyzed testify to the validity of the hypothesis of the correlation between superfluidity and Bose-Einstein condensation. The study of elementary excitations in helium 2 is analyzed. The different experimental data on the value of the roton-roton interaction constant are compared.

5675 **(RL—83-117) Stability of a Bose Condensate in the presence of regular and irregular potentials.** Gunn, J.M.F. (Rutherford Appleton Lab., Chilton (UK)). May 1984. 44p. (RAL—83-117). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700062.

The stability of an interacting Bose Condensate in the presence of a periodic potential is discussed. The condensate is destroyed if the potential is sufficiently strong, for certain densities of particles. Secondly irregular potentials of two types are considered: a dilute set of "defect" potentials in an otherwise periodic potential; and a highly irregular potential. In the first case, if the defect potential is sufficiently strong, the condensate is found to have a depletion which varies with the concentration of the defects. In the latter case it is argued that the condensate is totally destroyed. The consequences of the theory for experiments on ^{4}He films are discussed, and some new experiments proposed.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 6450005121

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 6451005717, 5718, 5743, 5806, 5809, 5813, 5813

5676 **(ANL-HEP-CP—84-66) Dijet production in hadron collisions at Fermilab.** Fields, T.H. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 2p. (CONF-840757—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002544.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

We have studied dijet final states produced in hard hadron collisions at Fermilab using the E-609 calorimetric detector. Using dijet events produced in π^-p, π^+p and pp collisions at 200 GeV, we have made a detailed search for the higher-twist process proposed by Berger and Brodsky. In this process, the entire energy at the incident pion goes into dijet production, leaving an event with no forward beam jet and satisfying two-body kinematics.

5677 **(BNL—35183) Jet physics in e+e- interactions.** Paige, F.E. (Brookhaven National Lab., Upton, NY (USA)). 7 Apr 1984. Contract AC02-76CH00016. 9p. (CONF-8404163—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000587.

From 6. international conference on high energy physics; Nashville, TN, USA (6 Apr 1984).

The status of QCD predictions for jets in e^+e^- interactions is reviewed. 33 references.

5678 **(BNL—35277) Glueball candidates in hadroproduction.** Chung, S.U. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 16p. (CONF-8406183—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000237.

From 15. international symposium on multiparticle dynamics; Lund, Sweden (11 Jun 1984).

Glueball candidates in hadron-hadron collision processes are reviewed. So far, candidates have been reported in J/sup PC/ = 0^{++}, 2^{++} and 0^{-+} but none in the exotic J/sup PC/ such as 1^{-+}. 23 references.

5679 **(DOE/ER/05490—59) New limits on the mass of majorana neutrino and right-handed heavy bosons.** Fazely, A.; Imlay, R.; Matsuki, T.; Metcalf, W. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1983. Contract AS05-77ER05490. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000008.

In double β-decay, the nuclear matrix element can be used to set new limits on the mass of Marjorana electron neutrinos or right-handed heavy W bosons. We also suggest derivation of the double β-decay matrix element from the forward angle cross sections for a double Gamow-Teller ($0^+ \rightarrow 0^+$) transitions via the (π^-,π^+) double charge exchange on a ^{48}Ti target. After corrections for distortion effects and the pion-two nucleons effective interaction the cross sections are equal to the square of the double β-decay matrix elements.

5680 **(DOE/ER/40033—65) Study of e^+e^- pairs in the mass range 11 to 25 GeV/c^2 at the CERN intersecting storage rings.** CERN-Michigan State-Oxford-Rockefeller Collaboration (CMOR). (Michigan State Univ., East Lansing (USA); Oxford Univ. (UK); Rockefeller Univ., New York (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1984. Contract AC02-81ER40033. 14p. (CONF-840757—18). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001832.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

A sample of 58 e^+e^- events with an invariant mass greater than 11 GeV/c^2 produced in pp collisions at a centre of mass energy of 62.3 GeV is discussed. The cross sections as a function of the mass and tranverse momentum are presented. The electron pairs are produced with a mean transverse momentum of 2.50 +- 0.25 GeV/c. 13 references.

5681 **(DOE/ER/40033—66) Study of associated particles and second order processes in electron production at the CERN ISR.** CERN-Michigan State-Oxford-Rockefeller Collaboration (CMOR). (Michigan State Univ., East Lansing (USA); Oxford Univ. (UK); Rockefeller Univ., New York (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1984. Contract AC02-81ER40033. 11p. (CONF-840757—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001827.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

The multiplicity of particles associated with electron pairs with mass greater than 11 GeV/c^2 is found to increase with the transverse momentum, P/sub Tau/, of the electron pair. The associated particles are observed to recoil against the electron pair and compensate locally its transverse momentum. The data are also found to be consistent with a scaling law of the form: s^2p^3/sub T/ $d^3\sigma/dm^2dydp$ tau^2 = H (x/sub Tau/, y, tau), when compared to lower $\sqrt{s}$ dimuon data.

5682 **(DOE/ER/40105—511) Experimental and theoretical high energy physics. Progress report, January 1-December 31, 1984.** (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy). 1984. Contract AC02-83ER40105. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85000844.

Experimental high energy physics studies reported include: testing of grand unified and supersymmetric models of the fundamental interactions through a search for proton decay and other rare phenomena; study of quantum chromodynamics in high energy, large angle hadronic interactions; study of weak interactions with emphasis on CP violation in neutral kaon decay; and a search for fractionally charged particles. Theoretical study covered: two-point functions for confining potentials; duality, moments and Regge trajectories in nonrelativistic quantum mechanics; confined solutions to the massless quantum chromodynamics in 1+1 dimensions; phenomenology of supersymmetry; theories with broken supergravity and grand unification near the Planck scale; proton decay in non-minimal conventional GUTS; chiral symmetry and vector meson dominance; radiative decay of hyperons; KNO scaling and its violation; Schwinger model in the new wave equation formalism; nonperturbative nonrenormalization theorem for supersymmetric QCD; compositeness scale; positive and neutral pion mass difference at finite temperature; standard model without Higgs mechanism; nonstandard fermion mass matrices and nucleon decay; plasmon effects leading to possible strong coupling behavior in high temperature gauge theories; nucleon decay vs. baryogenesis in supersymmetric inflationary cosmologies; and properties of a fermion bound to a GUT monopole. (LEW)

5683 **(IC—83/222) Ground state binding energies of Λ particle in hypernuclei.** Ahmad, I.; Mian, M.; Rahman Khan, M.Z. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780100.

We show that the folding model with a density dependent effective ΛN interaction satisfactorily explains the available Λ binding energy data of p shell and other heavier hypernuclei.

5684 **(IFIN-HE—102-1981) Inelastic cross sections and πp -meson production in relativistic nuclear collisions induced by p, d, ^{4}He and ^{12}C on ^{12}C and ^{181}Ta target-nuclei.** Chasnikov, I.Ya.; Izbasarov, M.I.; Vinitsky, A.Kh.; Abdinov, O.B.; Agakishiev, G.N.; Backovic, S.; Damianovich, V.; Drndarevic, S.; Krmpotic, D.; Krpic, D. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700172.

Experimental data on inelastic cross sections and π^--meson production in interactions initiated by protons with the incident momentum in the range (2-10) GeV/c and by deuterons, alphas and carbon nuclei with the incident momentum per nucleon in the range (2-5) GeV/c on carbon and tantalum target-nuclei are presented. The experimental data have been obtained using the 2 m propane bubble chamber. The analysis of the experimental data has been made in the framework of various theoretical models.

5685 **(IFVE-OEIPK—83-43) Two-particle inclusive and semi-inclusive rapidity distributions of πip mesons in K^-p interactions at 32 GeV/c.** Bumazhnov, V.A.; Babintsev, V.V.; Bogolyubskij, M.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 24p. (In Russian). (SERP-E—77). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703362.

The inclusive and semi inclusive invariant differential cross sections of pair π^{+-} mesons for different charged states in K^-p-interactions at 32 GeV/c are presented as functions of rapidity. Inclusive and semi inclusive production cross sections of pair π^{+-} mesons are determined. The obtained experimental distributions are compared with predictions of quark recombination model.

5686 **(IFVE-OEIPK—83-97) Measurement of cross sections for neutral strange particle production in anti pp-interactions at 32 GeV/c and comparison with the pp-interaction data.** Ermolov, P.F.; Kruglov, N.A.; Proskuryakov, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 23p. (SERP-E—138). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703363.

The data on inclusive and topological cross sections for neutral strange particle production in anti pp-interactions at 32 GeV/c obtained in the "Mirabelle" bubble chamber are presented. The inclusive cross sections of Λ and anti Λ-hyperons and Ksup(n)-mesons, where Ksup(n) is K^0 or anti K^0-meson, are found to be equal to $\sigma(\Lambda)$=1.72+-0.10 mb, σ(anti Λ)=1.5+-0.2 mb, and σ(Ksup(n))=6.19+-0.12 mb. The corresponding anti pp and pp cross sections are compared at nearby energies.

5687 **(IFVE-OEIPK—83-128) Study on spin alignment of rho^0(770) meson in K^-p and anti pp interactions at 32 GeV/c.** Kozlovskij, E.A.; Babintsev, V.V.; Borovikov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703360.

The alignment of spin of the rho-meson inclusively produced in K^-p- and pp-interactions at 32 GeV/c has been investigated.

Particle distribution from rho°-meson decay over, cos thetasub(N) has been has been deconstructed with respect to the normal to the reaction plane in the resonance restframe. The value for the spin matrices element of the rhosub(00)sup(N) denisty in this coordinate systems is found to agree in both cases with an assumption on the absence of rho°(770) spin alignment.

5688 **(IFVE-OEIPK—83-152) Study on the inclusive PHI meson production in association with other particles in K^+p reactions at 32 GeV/c.** Azhinenko, I.V.; Gritsaenko, I.A.; Uvarov, V.A.; Shlyapnikov, P.V.; Vol'f, E.A.; Tomaradze, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 23p. (In Russian). (SERP-E—133). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703361.

Results on inclusive phi meson production obtained in at K^+p experiment 32 GeV/c with the bubble chamber Mirabelle are presented. First data on inclusive phi production associated with p, Ksup(0, +), anti Λ, π^{+-} particles and $\Delta^{++}(1232)$, rho$_0$° and $K^{*+}(890)$ resonances are obtained. These data and the ones on prompt non-diffractive Ksup(0, +), anti Λ, π^{+-} particles K*sup(+, 0)(890) inclusive production are compared in details with the Lund fragmentation model. Experimental results suggest that spin effects play important role on particle production in soft hadronic collisions.

5689 (INS-NUMA—36, pp 60-68) **Study of Zo* and dibaryons and polarization experiments at KEK.** Masaike, Akira (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

The angular distribution of the polarization parameters was measured in $K^+n \rightarrow K^+n$, K^0p reactions with incident momenta of 1.06 GeV/c, 1.28 GeV/c, 1.39 GeV/c and 1.49 GeV/c. Based on the results combined with other observed parameters, a new energy dependent phase shift analysis was performed for I = 0 and I = 1 channels. The Argand plots for P_{13}, P_{01} and D_{03} waves showed counter clockwise circles. The peaks of the speed plots for P_{13} and D_{03} waves were near the expected resonance points. The large bumps at 1.1 GeV/c and 0.75 GeV/c in the total cross sections for I = 0 channel were explained by the contribution from D_{03} wave and P_{01} wave, respectively. By fitting with the Breit-Wigner formula, the mass, the width and the elasticity were found for D_{03}, P_{01} and P_{13} waves. The angular distribution of the polarization parameters for pn elastic scattering was also measured. The analysis based on the data obtained suggested resonance-like behavior in $^3D_1$ and $^3D_3$ waves at high energy in addition to $^1F_3$ wave for I = 0 channel.

5690 (INS-PH—2, pp 65-77) **Proton-proton interactions of 0.9 -- 2.0 GeV/c and 2.0 -- 4.0 GeV/c.** Shimizu, Fumiya (Tokyo Univ. (Japan). Faculty of Science). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

We have studied about 44,000 proton-proton interactions, at eleven incident beam momenta between 0.9 and 2.0 Gev/c, using the KEK 1 m hydrogen bubble chamber. We obtained the total cross section, the elastic total cross section and the reaction cross sections of $d\pi^+$, $pp\pi^0$, $pn\pi^+$, as functions of incident momentum. All are absolute cross sections. We also studied the angular distributions of the above reactions and the effective mass spectra in the three-body final states, $pp\pi^0$ and $pn\pi^+$. The total cross sections and elastic angular distributions agree with phase shift analyses of Arndt and Hoshizaki, both of which found resonance-like behaviours in the Argand plots of the $^1D_2$ and $^3F_3$. The inelastic cross sections agree with an isospin decomposition model of VerWest and Arndt, and indicates very small inelasticities in the I = 0 amplitudes of the nucleon-nucleon interactions in this energy range. By studying the effective mass spectra, we found that about 80 % of the reaction $pn\pi^+$ goes through the quasi two-body process, $pp \rightarrow n\Delta^{++}$. The decay angular distributions of the Δ^{++}, indicate that the spin state of the Δ^{++} does not depend on the incident beam momentum, and that this reaction proceeds via the single pion exchange mechanism. We have found no prominent signatures of dibaryons.

5691 (INS-PH—2, pp 78-83) **Polarization experiments of pn and π^+d elastic scattering at KEK.** Masaike, Akira (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

The measurement of polarization parameters of the pn elastic scattering in the dibaryon resonance region at KEK is discribed. The vector polarization of the π^+d elastic scattering which is now being measured is also discussed.

5692 **(JINR—1-83-652) Inelastic interactions of protons and alpha particles with nuclei at 4.5 GeV/c per nucleon with fast hadron backward emission.** Vokal, S.; Shabratova, G.S.; Shumbera, M.; Togoo, R.; Tuchek, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703366.

A study on general characteristics of events accompanied by the emission of fast hadrons into the backward hemisphere in the laboratory system has been carried out for interactions of protons and alpha-particles with nuclei at a momentum of 4.5 GeV/c per nucleon. A unified description of multiplicity distributions of these hadrons for interactions with light and heavy emulsion nuclei has been found. It is shown that the selection of events with fast hadrons escape backward leads to complete disintegration of light nuclei and a strong desintegration of heavy nuclei. A comparison with the cascade evaporation model, carried out for αA interactions, shows that the model overestimates the multiplication of secondary particles, particularly for light target nuclei.

5693 **(JINR—R-1-83-805) Multiplicity distributions of the π0-mesons in dTa and CTa interactions at 4,2 GeV/c per nucleon.** Gulkanyan, G.R.; Kanarek, T.; Kladnitskaya, E.N.; Korchagin, S.A.; Cheplakov, A.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703364.

The results of reconstruction of the π^0-meson multiplicity distributions on the basis of distributions over number of registered γ-quanta for dTa- and CTa interactions at 4.2 GeV/c per nucleon are presented. The reconstructed π^0-meson multiplicity distributions are compared with experimental distributions over π^--meson for the same interactions. The dependence of average number of π^0-meson on π^--meson number in dTa and CTa events has been obtained. Experimental data over multiplicity of π^0-mesons are compared with the cascade model calculations.

5694 **(JINR—R-1-83-823) Fragmentation of quarks and diquarks in πp p interactions at P=40 GeV/c.** Grishin, V.G.; Didenko, L.A.; Metreveli, Z.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703365.

The fragmentation of quarks and diquarks is studied in π^-P-interactions at 40 GeV/c. Invariant Xsub(F) distributions Fsup(πsup(+-))(Xsub(F)) and non-invariant distributions Dsup(πsup(+-)) (xsub(F)) (fragmentation functions) are compared with the analogous data on π(anti ν)p-interactions. It is shown that good agreement exists in the region ' Xsub(F) ' > or approximately 0.1,. for these different processes. The average et charge < 0 > for forward (< Q > F approximately -0.52+-0.03) and backward (< Q > B approximately 0.83+-0.03) directions in the c. m. s. of π^-p-interactions is determined. The obtained values of < Q > are in agreement with the expected values for additive quark model. The obtained results indicate that the fragmentation of quarks and diquarks in soft π^-p-interactions are similar to those in hard ν(anti ν)p-scattering.

5695 **(RAL—84-039) Investigation of narrow meson resonance production in antiproton-proton and antiproton-neutron interactions at 6.1 and 8.9 GeV/c.** Azooz, F.; Butterworth, I.; Dornan, P.J. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 38p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700073.

The authors made a comprehensive search for narrow meson resonance production in reactions of the type p-barN → π^{+-} sub(fast)X and p-barN → psub(fast)(sub(n-bar)sup(p-bar)X at 6.1 and 8.9 GeV.c in a triggered bubble chamber experiment at the SLAC Hybrid Facility. From a study of all accessible inclusive, semi-inclusive and exclusive states, upper limits are given for production of non-strange resonances with width < 20 - 40 MeV/c². The authors find two further peaks of statistical significance in excess of 4 standard deviations with masses in the M approx. 2 GeV/c² region, and one further multipion peak with mass approx. 1.54 GeV/c².

5696 **(SLAC-PUB—3446) Lifetime measurements for bottom hadrons.** Wolf, G. (Stanford Linear Accelerator Center, CA (USA); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1984. Contract AC03-76SF00515. 3p. (CONF-840757—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001941.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

The review of lifetime measurements of bottom hadrons begins with a first measurement by JADE, followed by similar measurements by MAC and MKII groups. New MAC data are reviewed based on a total of 75,000 multihadron events taken at a c.m. energy of 29 GeV. According to Monte Carlo calculations, 18% of the lepton candidates stem from charm decay and roughly 30% were misidentified hadrons. DELCO studied electrons obtained from 42,000 multihadron events at 29 GeV. The electrons were identified by means of Cerenkov counters. JADE analayzed 22,000 multihadron events at 35 GeV. Data were analyzed using two methods - one using a sample of b-enriched events, and the other using weighted distributions. The TASSO results were obtained with two different configurations of the detector - one of which used a drift chamber and the other a vertex detector. (LEW)

5697 **(TRI-PP—83-56) Differential cross section for proton-proton elastic scattering at 90° c.m. between 300 and 500 MeV.** Ottewell, D.; Walden, P.; Auld, E.G.; Giles, G.; Jones, G.; Lolos, G.J.; McParland, B.J.; Ziegler, W.; Falk, W. (TRIUMF, Vancouver, British Columbia (Canada)). Jul 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700074.

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The absolute differential cross section for proton-proton elastic scattering has been measured at 90° c.m. for 300, 350, 400, 450 and 500 MeV. The statistical uncertainty of the measurements is 0.5 percent with an additional systematic normalization uncertainty of 1.8 percent. The results are compared to phase shift analyses.

5698 **(TRI-PP—83-61) Valon-recombination description of target fragmentation in deep-inelastic μp, νp, antiνp scattering.** Zahir, M.S. (TRIUMF, Vancouver, British Columbia (Canada)). Jul 1983. 4p. (CONF-8306174—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700072.

From 14. international symposium on multiparticle dynamics; Granlibakken, CA, USA (22 Jun 1983).

Fragmentation of protons into pions in deep-inelastic semi-inclusive reactions induced by muon, neutrino and anti-neutrino in the target fragmentation region is considered in the framework of the valon-recombination model (VRM) and leading order perturbative QCD. Parameter-free predictions for the production of π^+ and π^- and their ratios are presented. Resonance contributions in the final state have also been taken into account.

5699 **Mass and lifetime limits on supersymmetric particles from a proton beam-dump experiment.** Vall, R.C.; Coffin, C.T.; Gustafson, H.R.; Leedom, I.D.; Jones, L.W.; Longo, M.J.; Roberts, T.J.; Roe, B.P.; Wang, E.; Castoldi, C. (University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* 53: No. 14, 1314-1317(1 Oct 1984).

Muonless events from the prompt-neutrino experiment at Fermilab have been analyzed to set limits on the masses and decays of supersymmetric particles by means of three measurements; (1) the ν/sub e//ν/sub μ/ ratio, (2) the rate of events consisting of electromagnetic showers only, and (3) the event rate at large transverse momentum. These limits are based upon the absence of events above our visible energy cutoff of 20 GeV which could be attributed to supersymmetry. Several hypotheses concerning supersymmetric particle decays are considered.

5700 **Upper limit on flavor-changing neutral-current decays of the b quark.** Avery, P.; Bebek, C.; Berkelman, K.; Cassel, D.G.; DeWire, J.W.; Ehrlich, R.; Ferguson, T.; Galik, R.; Gilchriese, M.G.D.; Gittlemen, B. (Cornell University, Ithaca, New York 14853). *Physical Review Letters;* 53: No. 14, 1309-1313(1 Oct 1984).

We have searched for flavor-changing neutral-current weak decays of the b quark and find R/sub B/(b→l$^+$l$^-$X)<0.31 at 90% confidence level. This limit excludes models with the b quark in a left-handed isosinglet. We also place limits on the ratio of the B^{+-} and B^0 semileptonic branching fractions and on B^0B-bar ^{0} mixing.

5701 **Has a heavy new pseudoscalar been detected?.** Marciano, W.J. (Department of Physics, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* 53: No. 10, 975-978(3 Sep 1984). Contract AC02-76CH00016.

I speculate that heavy (≃93 GeV) pseudoscalar decays are responsible for the radiative $e^+e^-\gamma$, $\mu^+\mu^-\gamma$, and missing energy $+\gamma$ events observed at the CERN p-barp collider. Decay signatures and the production cross section of this new particle are analyzed. For a consistent scenario, it seems that this pseudoscalar must be the partner of a "composite" Z boson.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 6452005689, 5690, 5759, 5763, 5770, 5776, 5779, 5799, 5801, 5803, 5804, 5805, 5819, 5915, 5921

5702 **(DESY—84-029) Relativistic quarkonium potential model.** Klima, B.; Maor, U. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1984. 11p. (CONF-8403121—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE84752267.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

We review a recently developed relativistic quark-antiquark bound state equation using the expansion in intermediate states. Using a QCD motivated potential we succeeded very well to fit both the heavy systems (b anti b, c anti c) and the light systems (s anti s, u anti u and d anti d). Here we emphasize our results on heavy-light systems and on the possible (t anti t) family.

5703 **(DOE/ER/03992—562) Hybrid model for baryons.** Biedenharn, L.C.; Dothan, Y.; Stern, A. (Texas Univ., Austin (USA). Center for Particle Theory). Jul 1984. Contract AS05-76ER03992. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001835.

We review the Skyrme model and discuss a method for incorporating quark degrees of freedom into the model. In addition, by generalizing the Skyrme/quark model to three flavors and taking into account the Wess-Zumino term, we obtain a condition on the SU(3) charges in the quark sector of the theory.

5704 **(DOE/ER/03992—563) Higgs interpretation of zeta (8.3 GeV).** Nandi, S. (Texas Univ., Austin (USA). Center for Particle Theory). Oct 1984. Contract AS05-76ER03992. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001826.

We interpret the recently observed zeta (8.3 GeV) to be a Higgs boson of the SU(2) x U(1) model with two Higgs doublets. If zeta is a Nambu-Goldstone boson of a new approximate symmetry, then a second light neutral Higgs of mass less than 25 GeV is expected. Our fermion couplings enhance the rate for Y → γ + zeta

by ~ 100 compared to the standard one Higgs model. Other experimental tests are suggested.

5705 **(IC—83/166) Inverse scattering equations for the non-linear SO(1,2)/SO(1,1) σ-model in two dimension.** Chowdhury, A.R. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700025.

Inverse scattering equations are derived for the SO(1,2)/SO(1,1) nonlinear σ-model through the pseudopotential approach.

5706 **(IC—83/181) Charge radii of Σ0 and >⁰.** Parashar, D. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700075.

The charge structure of low lying spin 1/2(8) baryons is investigated in terms of their radii, $<r^2>$, using the assumption of nonfactorizability of transverse parton momentum distribution and the requirement that the u- and d-quarks inside a nucleon are described by "separate" spatial distributions. Explicit calculations lead to the startling prediction that the charge radii of all neutral baryons are negative in sign and nonvanishing in magnitude.

5707 **(IC—83/228) Parity violating asymmetry in high energy proton-nucleon scattering.** Singh, S.K.; Ahmad, I. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700082.

Parity violating asymmetry in high energy proton-nucleon scattering has been studied using the Glauber theory and meson exchange potential model for weak interactions. By varying the weak interaction parameters within the allowed range, we find that it is possible to get the theoretical asymmetries to agree in sign with the observed ones in p-vector-H_2O scattering at 1.5 and 6.0 Gev/c but not in magnitude which always remains much smaller.

5708 **(IFIN-FT—201-1981) Unitarity lower bounds on logarithmic slope of diffraction peak.** Ion, D.B. (Institutul Central de Fizica, Bucharest (Romania)). Apr 1981. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700166.

Via Lagrange multipliers for equality and inequality constraints, rigorous lower bounds on the logarithmic slope of diffraction peak are derived assuming unitarity and a fixed total elastic σsub(el) and forward differential dσsub(el)/dσ (0deg) cross section. Comparison with the experimental data of antip p and pp scattering shows that the relative departure from the unitarity bound is about 11% for all Psub(LAB) > 1 GeV/c.

5709 **(IFIN-FT—212-1982) Quark model predictions for the pseudoscalar meson decays into lepton pairs: $\pi 0 \rightarrow e^+e^-$, eta $\rightarrow \mu^+\mu^-$, Ksub(L)⁰ $\rightarrow \mu^+\mu^-$.** Scadron, M.D.; Visinescu, M. (Institutul Central de Fizica, Bucharest (Romania)). Jun 1982. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700159.

The pseudoscalar decays $P \rightarrow l^+ l^-$ are driven by second order electromagnetic loop diagrams which are rendered finite using appropriate off-shell $P \rightarrow \gamma\gamma$ form factors determined in the quark model. The theoretical predictions are in good agreement with the experimental rates and branching ratios and with the unitarity bounds for each decay $\pi^0 \rightarrow e^+e^-$, eta $\rightarrow \mu^+\mu^-$ and Ksub(L)⁰ $\rightarrow \mu^+\mu^-$.

5710 **(IFIN-FT—218-1982) Scaling and s-channel helicity conservation via optimum principle in hadron-hadron scattering.** Ion, D.B. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700162.

Two important physical laws of the hadron-hadron scattering at high energies: the scaling of angular distributions and the s-channel helicity conservation, are generated via principle of maximum probability, that any scattering process behaves as to maximize the total unpolarized cross section when the elastic unpolarized cross section is fixed. A generalization of Rarita-Schwed theorem is obtained. A specific interpretation of Morrison D-resonances as optimal resonances is suggested.

5711 **(IFIN-HE—104-1982) Triple Regge analysis of the reaction $PI^- p \rightarrow \Lambda + X$ at 16 GeV/c.** Coca, C.; Karnauchov, V.M. (Institutul Central de Fizica, Bucharest (Romania)). Apr 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700163.

The inclusive reaction $PI^- p \rightarrow \Lambda + X$ at 16 GeV/c beam momentum has been analysed in terms of triple Regge formalism. Assuming the Pomeron dominance the effective trajectory obtained from fit to the Msub(X)² distribution in different t-bins is compatible with that of the Ksup(*)-trajectory. The description of the data for production in the target fragmentation domain at 16 GeV/c offered by this simple model is found to be remarkably good over a large region of phase space.

5712 **(IFVE-OEIPK—83-93) Estimation of cross sections of different channels of strange particle production in anti pp interactions at 32 GeV/c.** Ermolov, P.F.; Kruglov, N.A.; Proskuryakov, A.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703347.

The cross sections of the main channels of production of two and four strange particles in all charged states have been defined from the measured cross sections of neutral strange particles with S=+-1. The inclusive strange-quark pair production cross section corrected for the channels with >-hyperons is found to be 11.06+-0.66 mb and the cross section for production of two strange-quark pairs to be 0.5+-0.17 mb. There is an evidence that in anti pp-annihilation strange particles are produced mainly in annihilation of one pair of valence quarks.

5713 **(IFVE-OTF—83-49) Properties of meson resonances from QCD duality.** Griogoryan, S.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703348.

QCD duality relations are applied to the description of meson resonances consisting of u, d quarks with Jsup(PC)=1sup(--), 1^{++}, 2^{++}, 2^{-+}, 0^{-+}, 0^{++}. The masses and coupling constants of the lowest, as well as radially excited states, are predicted in a good agreement with available experimental data. In particular for the vector states the mass spectrum msub(n)sup(2)=msub(rho, ω)sup(2)(1+3.28n) has been obtained.

5714 (INS-NUMA—36, pp 78-81) **K barN interaction using Y* resonance as elementary particles.** Kimura, Masahiro (Science Univ. of Tokyo (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

An effective Lagrangian describing the interaction between the D(3/2) resonance of Y* particles and meson-nucleon systems was constructed, and applied to K^-N scattering. It was assumed that only the D(3/2) resonance state Y* (1520) with I = 0 is effective near the kaon momentum of 400 MeV/c, and the effective Lagrangian was obtained by generalizing that of the P(3/2) resonance state Y* (1385) and meson-nucleon systems. The K matrix for each particle channel ($\pi\Lambda$, $\pi\Sigma$, K^-N) and for each partial wave channel (S,P,D and I = 0, 1) was calculated from the effective Lagrangian, and the cross section for each particle channel was compared with the experiments. In the region Pk(kaon momentum) < 300 MeV/C, only the S waves were used for the calculation, and seven parameters were determined by the least square method. The contribution from the P waves was not seen except the region 300 MeV/c < Pk < 700 MeV/c. The contribution from the D waves was conspicuously seen near Pk = 400 MeV/c as the peak of Y* (1520). No sharp peak in sigma ($k^-p \rightarrow k^-p$) suggests the necessity of the D waves with I = 1 which cancel the peak due to Y* (1520).

5715 (INS-NUMA—36, pp 82-87) **Inelastic scattering of kaons on ^{12}C.** Toyama, Fumiharu (Osaka Univ., Suita (Japan). Research Center for Nuclear Physics). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

The DWIA based on Glauber model using single inelastic collision approximation and the DWIA using Tassie model for transition density were compared with the recent experiment of kaon elastic scattering by ^{12}C and inelastic scattering by BNL group. In the Glauber model with single inelastic collision approximation, the distortion effect is expressed by the elastic scattering amplitude which was obtained by converting the K^{+-}-^{12}C elastic scattering amplitude into the scattering amplitude by eleven-nucleon system. As the wave function of ^{12}C, that of the harmonic oscillator type with the length parameter 1.61 fm was adopted, and the reduced form factor was determined from electron inelastic scattering. As for the K^--^{12}C scattering, the parameter free calculation was able to explain the data both for elastic and inelastic cases. On the other hand, the calculation of K^+-^{12}C scattering did not agree with the experimental data. In the DWIA calculation with the Tassie model as the transition density, only the density distribution of nucleons of ground state was necessary as an input. The density distribution by the harmonic oscillator wave function did not reproduce the experimental data, and the density distribution of Wood-Saxon form improved the agreement in the transition into 2^+ states in K^--^{12}C scattering.

5716 (INS-PH—2, pp 18-38) **Dibaryon resonances in γd reactions.** Nakamura, Kenzo (Tokyo Univ. (Japan). Dept. of Physics). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

Possible effects of dibaryon resonances appearing in γd reactions are surveyed. After introductory remarks on the dibaryon resonances in sect. 1, present status of the experimental investigations on $\gamma d \rightarrow pn$, $\gamma d \rightarrow pp\pi^-$, $\gamma d \rightarrow pX$ reactions is reviewed in sect. 2. The results of the theoretical analyses on the $\gamma d \rightarrow pn$ reaction are surveyed in sect. 3. In sect. 4, various aspects of the ΔΔ bound state, which has been introduced to explain the large polarization observed in the $\gamma d \rightarrow pn$ reaction at E sub(γ) -- 500 MeV at theta* = 90°, are discussed. Finally in sect. 5 problems left for future experimental and theoretical investigations are summarized.

5717 (INS-PH—2, pp 45-63) **Reviews of N-N scattering experiments around 1 GeV and dibaryon resonances.** Shimizu, Hajime (Kyoto Univ. (Japan). Dept. of Physics). 20 Apr 1982. NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

Some experimental results in nucleon-nucleon scattering around 1 GeV are reviewed. Many structures are observed in various observables in nucleon-nucleon scattering. These may be some indications of dibaryon resonances.

5718 (JINR—D-1-83-602) **Diffractive production of a narrow baryon in neutron-carbon interactions.** Aleev, A.N.; Aref'ev, V.A.; Balandin, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703384.

A narrow baryon resonance Nsub(phi) with a mass of 1960 MeV/c², decaying into Σ^- (1385) and K^+, was observed in the experiments. In this paper results of an investigation of the resonance production mechanism are presented. It is shown that the resonance is produced in the diffraction of an incident neutron beam into a Σ^-(1385)K^+ system. For the slope parameter of the production differential cross section dσ/dPsub(T)sup(2) approximately esup(-b x Psub(T)sup(2)), b=(9.9+-3.0) (GeV/c)$^{-2}$. The cross section σ for the resonance production times the branching ratio B of the observed decay mode is σxB=(0.15+-0.04)μb per nucleon.

5719 (JINR—E-2-83-630) **Decay of a bound state of $A\mu i\mu^-$ pair into an e^+e^- Dalitz pair and a γ-quantum.** Kozlov, G.A.; Kuleshov, S.P.; Savrin, V.I.; Sanadze, V.V.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700063.

Submitted to the journal Theor. Math. Phys.

The behaviour of the decay form factor is studied for a bound $\mu^+\mu^-$-system in a state with zero total spin into an e^+e^- pair and a γ-quantum. The probability is calculated of the decay of the bound $\mu^+\mu^-$-state into two photons. The change of the muon mass by electron mass in the expression obtained results in a value for the probability of the parapositroium decay into two γ-quanta in agreement with experiment. 24 refs.; 2 figs.

5720 (JINR—R-2-83-746) **Description of structure functions of mesons in relativistic theory of bound states.** Linkevich, A.D.; Savrin, V.I.; Sanadze, V.V.; Skachkov, N.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703352.

On the basis of the Hamiltonian formulation of quantum field theory there are obtained formulae for the structure functions of two-body systems through the relativistic wave functions of bound states. In the impulse approximation the formula is obtained, which coincides with the corresponding expression obtained on the basis of the single-time formulation of the two-body problem. The formulae is obtained for the expression of meson structure functions, in terms of form factors of transitions into excited states.

5721 (KFKI—1984-51) **Radiative corrections for semileptonic decays of hyperons: the 'model independent' part.** Toth, K.; Szegoe, K.; Margaritis, T. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700065.

The 'model independent' part of the order α radiative correction due to virtual photon exchanges and inner bremsstrahlung is studied for semileptonic decays of hyperons. Numerical results of high accuracy are given for the relative correction to the branching ratio, the electron energy spectrum and the (Esub(e),Esub(f)) Dalitz distribution in the case of four different decays. 24 refs.; 6 tables.

5722 (KFKI—1984-52) **Remark on electron-neutrino correlation in semileptonic decays.** Toth, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700066.

It is pointed out that the presently available theoretical calculations for the radiative correction to the asub(eν-bar) correlation parameter in semileptonic decays are incompatible with the experimental methods used to determine this quantity. 7 refs.

5723 (KMU-HEP—83-06) **Hadronic event generation for hadron cascade calculations and detector simulation. 2. Inelastic hadron-nucleus collisions at energies below 5 GeV.** Haenssgen, K.; Moehring, H.J.; Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1983. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700164.

A model for inelastic hadron-nucleus interactions at energies between 0.1 and 5 GeV is described. It includes particle production, cascade proton and neutron emission, described via empirical formulae and nuclear excitation energy. All stable hadrons can be used as primary or secondary particles. The model is constructed via the Monte Carlo generation of complete events. Good agreement is found in comparing average multiplicities and single and double differential cross sections with experimental data.

5724 (KMU-HEP—83-08) **Processes $\gamma\gamma \rightarrow \mu^+\mu^-e^+e^-$, $\gamma\gamma \rightarrow e^+e^-e^+e^-$ and $\gamma\gamma \rightarrow \pi^+\pi^-e^+e^-$ for high energy γγ beams.** Kuraev, E.A.; Schiller, A.; Serbo, V.G. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700160.

Processes $\gamma\gamma \rightarrow \mu^+\mu^-e^+e^-$ (1), $\gamma\gamma \rightarrow e^+e^-e^+e^-$ (2) and $\gamma\gamma \rightarrow \pi^+\pi^-e^+e^-$ (3) with polarized photons are studied in detail. Reactions (1) and (2) are the most suitable ones to determine the luminosity for high energy $\gamma\gamma$ colliding beams. The application of the results to QCD multi-jet production in $\gamma\gamma$ collisions is briefly discussed. The result for σ/sub tot/ of process (3) does not coincide with the known one of Cheng and Wu.

5725 **(KMU-HEP—83-09) Hadron-nucleus and nucleus-nucleus collisions.** Ranft, R. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1983. 6p. (CONF-830718—32). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700165.

From International Europhysics conference on high energy physics; Brighton, UK (20 Jul 1983).

Results obtained in studying hadron-nucleus and nucleus-nucleus collisions are presented. Emphasis is laid on the multichain fragmentation model for particle production in hadron-hadron collisions and hadron-nucleus collisions, and its connection with a realistic hadronization scheme using the Monte Carlo chain decay code BAMJET. Furthermore, experimental papers on soft hadron-nucleus and nucleus-nucleus collisions are reviewed.

5726 **(LA-UR—84-2733) Stochastic evolutions and hadronization of highly excited hadronic matter.** Carruthers, P. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 9p. (CONF-8406189—2). NTIS, PC A02. File Number DE84016776.

From 4. international conference on ultrarelativistic nucleus-nucleus collisions - QUARK MATTER '84; Helsinki, Finland (17 Jun 1984).

Stochastic ingredients of high energy hadronic collisions are analyzed, with emphasis on multiplicity distributions. The conceptual simplicity of the k-cell negative binomial distribution is related to the evolution of probability distributions via the Fokker-Planck and related equations. The connection to underlying field theory ideas is sketched. 17 references.

5727 **(NIKHEF-H—84-2) Role of the five-point function in radiative corrections to two photon physics.** Neerven, W.L. van; Vermaseren, J.A.M. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Mar 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703351.

The authors have calculated the full virtual and soft radiative corrections to the two photon reaction $e^+e^- \rightarrow e^+e^-X$ with X a pointlike pseudoscalar particle. They find that the effect of the five-point functions from the exchange of an extra photon between the electron and the positron is negligible. This implies that this class of graphs can be ignored in all two photon reactions.

5728 **(NIKHEF-H—84-3) Two-loop large Higgs-mass correction to vector boson masses.** Bij, J.J. van der. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Mar 1984. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703350.

The leading two-loop correction to the masses of the vector bosons was calculated in the limit of large Higgs mass. The result is equal and of the same sign as the one-loop result for a Higgs-mass of about fifty-five times the vector boson mass. Therefore perturbation theory rigorously breaks down for a Higgs-mass of 4 TeV or larger.

5729 **(PB—84-221233) Glueballs. Final report.** Meshkov, S. (National Bureau of Standards, Washington, DC (USA)). 1983. 31p. Pub. in Proceedings of Hadronic Session (18th) held at Recontre de Moriond, La Plange-Savoie, France on January 23-29, 1983, Gluons and Heavy Flavours 1, p427-440 1983.

See also DE82-016963.

The current status of various glueball properties such as level ordering and masses is reviewed. The leading glueball candidates currently are the phi phi enhancements.

5730 **(RAL—84-002) Separation of quark flavours in e^+e^- annihilation and its applications.** Marshall, R. (Rutherford Appleton Lab., Chilton (UK)). May 1984. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700071.

The use of kinematic quantities to separate quark flavours is investigated. Quantitative methods of assessing the degree of separation are developed and used to select the best variable: transverse mass. The properties of transverse mass, derived from all particles in the quark jets are considered in detail. Finally, a few examples where the method can be applied are briefly described.

5731 **(RAL—84-033) Multileptons from heavy quarks.** Phillips, R.J.N. (Rutherford Appleton Lab., Chilton (UK)). Mar 1984. 11p. (CONF-8403121—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703353.

From New particle production at high energy meeting: The Recontre de Moriond; La Plagne, France (4 Mar 1984).

The paper is concerned with a brief look at the various multilepton signals that are expected at p-barp colliders from the production and cascade decay of top quarks, plus the backgrounds from b and c production.

5732 **(RL—83-099) Chiral Lagrangian calculation of nucleon branching ratios in the supersymmetric SU(5) model.** Chadha, S.; Daniel, M. (Rutherford Appleton Lab., Chilton (UK)). Dec 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700067.

The branching ratios are calculated for the two body nucleon decay modes involving pseudoscalars in the minimal SU(5) supersymmetric model with three generations using the techniques of chiral dynamics.

5733 **(RL—83-126) Search for glueballs in final state interactions.** Morgan, D.; Pennington, M.R. (Rutherford Appleton Lab., Chilton (UK)). Nov 1983. 7p. (DTP—83-24). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700068.

Models of confinement in QCD predict an isoscalar O^{++} glueball usually below 1 GeV. It is shown conclusively that the $pp \rightarrow pp\pi\pi$ Axial Field Spectrometer experiment at the ISR designed to discover such a state finds nothing below 1.15 GeV that is not seen in $\pi\pi$ elastic scattering. Elastic unitarity leaves little room for a distinction between $\pi\pi$ production by glue or quark initial states.

5734 **(SLAC-PUB—3406) O(18) revived.** Bagger, J.; Dimopoulos, S.; Masso, E. (Stanford Linear Accelerator Center, CA (USA)). Aug 1984. Contract AC03-76SF00515. 2p. (CONF-840757—22). NTIS, PC A02. File Number DE84017639.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

We present an O(18) theory which is pertubatively unifiable and which accounts for the absence of right-handed families in the low-energy world. The model gives rise to dramatic predictions for proton decay and for the Z^0 width.

5735 **(SLAC-PUB—3440) Recent developments in the theory of photon-photon collisions.** Brodsky. S.J. (Stanford Linear Accelerator Center, CA (USA)). Sep 1984. Contract AC03-76SF00515. 4p. (CONF-840757—20). NTIS, PC A02. File Number DE85002717.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

Over the past few years the field of photon-photon collisions has emerged as one of the best testing grounds for QCD, particularly in the area of exclusive and inclusive hard scattering processes, exotic resonance production, and detailed tests of the coupling of real and virtual photons to the quark current. In this summary of contributed papers, I will briefly review recent theoretical progress in the analysis of two-photon reactions and possible directions for future work. 29 references.

5736 **(TRI-PP—83-57) Nucleon axial form factor in some bag models.** Rinat, A.S. (TRIUMF, Vancouver, British Columbia (Canada)). Jul 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700069.

Submitted to Physics Letters B.

We compute gsub(A)(qsup(2)) for various bag models, including effects of an additional central force and recoil. For a confinement radius R approximately 0.85 fm predictions reproduce the data up to $q < 0.5$ fm, but fall faster than the observed dipole behaviour beyond.

5737 **(UWThPh—84-20) Relativistic corrections to quarkonium spectra.** Falkensteiner, P.; Grosse, H.; Schoeberl, F. (Vienna Univ. (Austria)). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703349.

We analyze relativistic corrections to energy levels up to order v^2/c^2 for potential models, show that the spin-independent contributions are comparable to the spin-dependent ones and give a few general relations for P-state splittings. We conclude that it is hardly possible to get a correct splitting for the PSI and/or T system.

5738 **(UWThPh—84-34) Exponential QCD-moments for charmonium $^3S_1$ up to order $<G^4>$.** Bertlmann, R.A.; Neufeld, H. (Vienna Univ. (Austria)). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700034.

In accordance with recent finding of Reinders, Rubinstein and Yazaki we show that for exponential QCD-moments of charmonium the corrections due to dimension six and eight operators are very small so that the ratio of moments used for mass determination remains remarkably stable.

5739 **(UWThPh—84-35) Composite scalar contributions to the anomalous magnetic moments.** Stremnitzer, H. (Vienna Univ. (Austria)). 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700064.

It is shown that the composite scalars recently introduced to explain the high $Z^0 \rightarrow e^+e^-\gamma$ rate contribute too much to the lepton anomalous magnetic moments, unless one uses very accurate chiral symmetry or composite models with two preonic scales.

5740 **(WIS-PH—83/43) Sum rules and systematics for baryon magnetic moments.** Lipkin, H.J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Nov 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703357.

The new experimental values of hyperon magnetic moments are compared with sum rules predicted from general quark models. Three difficulties encountered are not easily explained by simple models. The isovector contributions of nonstrange quarks to hyperon moments are smaller than the corresponding contribution to nucleon moments, indicating either appreciable configuration mixing in hyperon wave functions and absent in nucleons or an additional isovector contribution beyond that of valence quarks; e.g. from a pion cloud. The large magnitude of the THETA$^-$ moment may indicate that the strange quark contribution to the THETA moments is considerably larger than the value $\mu(\Lambda)$ predicted by simple models which have otherwise been very successful. The set of controversial values from different experiments of the Σ^- moment include a value very close to $-(1/2)\mu(\Sigma^+)$ which would indicate that strange quarks do not contribute at all to the Σ moments.

5741 **(WIS-PH—83/44) Confinement and the Rubakov-Callan effect.** Date, G.; Kugler, M. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Dec 1983. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703358.

We explore the effects of quark confining interactions on the Rubakov-Callan effect. The expectation value of the fermion bilinear operator PSI-bar PSI is computed in an SU(2) model with "quark" field satisfying the MIT bag boundary condition. The r dependence of the expectation of PSI-bar PSI is considerably modified near the bag surface signalling a possible suppression of processes initiated by states carrying a net "charge". The r dependence near the monopole core is unaffected. We also point out a possibility that the confinement dynamics may severely interfere with the existence of a condensate.

5742 **(WIS-PH—84/2) Theoretical basis and phenomenology of the OZI rule.** Lipkin, H.J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Jan 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703359.

No reliable theoretical recipe exists for predicting strengths of OZI-forbidden transitions proceeding via two OZI-allowed transitions like phi$\rightarrow K^+K^-$ $\rightarrow$rhoπ, $\pi^-p\rightarrow K^+K^-$ n$\rightarrow$phiphin or $\pi^-p\rightarrow$etan$\rightarrow$phiphin. Nonet symmetry, exchange degeneracy and duality suppress such transitions by cancellations between different diagrams. Unpredictable OZI violations are introduced by breaking of these symmetries. Phenomenological analyses of charmonium decays and meson photoproduction establish an empirical topological criterion for classifying some processes as less forbidden and suggest that $\pi^-p\rightarrow$phiphin should not be suppressed by a factor of more than three in amplitude. Its observation is not conclusive evidence for new exotic particles.

5743 **Implications of nonspectator B-meson decays and B-lifetime measurements.** Soni, A. (Department of Physics, University of California, Los Angeles, California 90024). *Physical Review Letters;* **53**: No. 15, 1407-1410(8 Oct 1984).

The nonspectator contributions to the B-meson decays are calculated with use of the measured ratio tau/sub $D/^+$/tau0 and the assumption f/sub $B/^2$/f/sub $D/^2$ = m/sub D//m/sub B/. We find tau/sub $B/^+$/tau0 = 1.4 to 1.8. From the measured values of B-meson lifetime, the semileptonic branching ratio, the ratio $\Gamma(b\rightarrow u e\nu)/\Gamma(b\rightarrow c e\nu)$, and the ϵ parameter, the constraints on Kobayashi-Maskawa angles are evaluated and their implications for m/sub t/, ϵ'/ϵ, B^0-B-bar ^{0} mixing, and K$\rightarrow\pi\nu$nu-bar are presented.

5744 **New derivation of the center-of-mass energy subtraction in the cavity approximation to the bag model.** Barnhill M.V. III. (Physics Department, University of Delaware, Newark, Delaware 19716). *Physical Review* [*Section*] *D: Particles and Fields;* **30**: No. 5, 1126-1128(1 Sep 1984).

It is shown that the subtraction of the center-of-mass energy that Donoghue and Johnson have shown to improve the bag-model estimate of the mass of the pion is consistent with an energy- and momentum-conserving calculation of elastic electromagnetic form factors. The center-of-mass energy subtraction follows from analyzing the rattling-mode states first found in the (1+1)-dimensional field theory of the bag.

5745 **Light composite fermions--an overview.** Raby, S. (Los Alamos National Lab., Los Alamos, NM). pp 365-378 of Field theory in elementary particles. New York, NY, USA; Plenum Press (1983).

Those rules which describe massless composite fermions and the breaking of chiral symmetry are discussed: 't Hooft's anomaly conditions, 't Hooft's decoupling conditions, and tumbling vs. no tumbling. The anomaly conditions are not sufficient to determine the spectrum of massless composites. If the breaking of chiral symmetry is considered a dynamic question, massless composite fermions are not required. The decoupling conditions are also changed, and the persistent mass hypothesis is applied. So, one needs to give massless fermions mass. As exact chiral symmetry G flavor protects fermions from getting mass (by 't Hooft's anomaly conditions) G flavor must be broken. Four mechanisms are suggested: weak gauging I, weak Gauging II, strong gauging, and unification. Generation number, and the generational symmetry, is also examined.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 6453005745

5746 **(DOE/ER/40008—66) Supersymmetric Kosterlitz-Thouless phase transition.** Doria, M.M. (Florida Univ., Gainesville (USA). Dept. of Physics). 1984. Contract AS05-81ER40008. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003236.

Supersymmetry is introduced in the Coulomb gas, namely the statistical theory for a set of interacting vortices and antivortices. The equivalence of this theory to the supersymmetric Sine-Gordon model is established. Mean-field considerations applied to this supersymmetric Coulomb gas lead to a phase transition of the kind described by Kosterlitz and Thouless. 12 references.

5747 **(DOE/ER/40108—2) Determinations of P, and CP, for heavy mesons and tests for their violations without polarization experiments.** Nelson, C.A. (State Univ. of New York, Binghamton (USA). Dept. of Physics). Oct 1984. Contract AC02-83ER40108. 9p. (CONF-8409162—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000017.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

Powerful results are tabulated which can be used at modern colliders to make fundamental symmetry tests by analysis of sequential decays of $X \rightarrow V_1V_2$. By generalization of the phi phi parity test which has recently been used to determine the parity of the eta/sub c/, the P (or CP) quantum number can always be determined for X of any spin J which decays P (or respectively CP) invariantly into VV or V anti V where each vector meson decays into two spin-0 bosons, or is ω. P can also always be determined from a mode like K^{*+} anti K^{*0}. A neutral spin-0 technipion and an elementary Higgs particle, for instance, can be distinguished by such CP invariant decay modes and by phi rho^0, phi J, J Y, or if sufficiently massive by phi Z^0 or JZ^0 where J/psi and Z^0 go into a lepton-antilepton pair. Generalization to the gZ^0 and gg decay channels, g = gluon jet, which would be relevant to new resonance physics, for example, at the CERN collider is discussed. There are also very simple tests for possible violations of P, of the combination of C plus isospin, of both P and CP, and of both C and CP. 9 references.

5748 **(UWThPh—84-21) Relevance of long-distance contributions to CP violation in the K^0 system.** Ecker, G. (Vienna Univ. (Austria)). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703354.

The sensitivity of the CP violating parameter epsilon to long-distance contributions to the K^0 average K^0 mass matrix is estimated on general grounds. Improving the accuracy in the measurement of epsilon'/epsilon by an order of magnitude will unambiguously decide whether the standard model can account for CP violation for msub(t) < or approximately 50 GeV.

5749 **Parity nonconservation in atomic thallium.** Drell, P.S.; Commins, E.D. (Physics Department, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* 53: No. 10, 968-971(3 Sep 1984). Contract AC03-76SF00098.

We present new measurements of parity conservation in the 293-nm transition in atomic 2 $_{81}{}^{205}$Tl. Linearly polarized 293-nm photons, polarization epsilon-circumflex, are absorbed by 6^2P/sub 1/2/ atoms in crossed electric and magnetic fields. The transition probability for each Zeeman component contains a term proportional to epsilon-circumflexxBepsilon-circumflexxE x B arising from interference between the Stark E1 amplitude βE and the parity-nonconserving E1 amplitude scrE/sub p/. Our result [Imscr E/sub p//β]/sub expt/ = -1.73 +- 0.33 mV/cm, is compared with estimates based on the standard electroweak model.

5750 **Nonabelian monopoles break color.** Balachandran, A.P. (Syracuse Univ., Syracuse, NY, USA). pp 17-24 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

This chapter contends that when a symmetry group G spontaneously breaks to H, and it creates nonabelian monopoles, then the concept of H as a transformation group partially breaks down in the vicinity of such monopoles, and only the transformations of certain distinguished subgroups of H can be consistently implemented on the states. Nonabelian monopoles emit long range nonabelian (and possibly also abelian) magnetic fields, and are associated with the nonabelian "unbroken" subgroup H. The monopole in the U-gauge is considered. It is concluded that the incompatibility of generic H transformations and superselection rules provide strong support to the finding that the transformations of the "unbroken" subgroup H cannot be implemented in the presence of a nonabelian monopole.

6454 Field Theory

REFER ALSO TO CITATION(S) 6454005630, 5640, 5734, 5738, 5741, 5987, 5990

5751 **(BONN-HE—84-7) Monopoles in high temperature SU(2) pure Yang-Mills theory.** Dahlem, K.J. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1984. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750004.

In this discussion we examine the question of the screening of chromomagnetic fields in the simplest nonabelian high temperature gauge theory in 4 dimensions. We find, it is favourable for the system to generate monopoles with a mass M proportional T. The high temperature monopole plasma causes a finite screening length in good agreement with published MC values. The self-consistency of the approach obtains, as the monopole core radius, determined by a variational argument, turns out to be approximately equal to the calculated magnetic screening length. Finally after a speculation on the monopole condensation, we give a simple scaling argument, which yields a critical temperature, surprisingly close to the MC calculated value.

5752 **(CTA-IEAV-RP—009/83) Effective potential for fermions in the two-dimensional electrodynamics.** Garcia, R.L. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Nov 1983. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700153.

From 4. National Workshop on Particle-and Fields Physics; Itatiaia, RJ (Brazil) (1983).

By the use of functional methods and dimensional regularization in the one-loop approximation, the nullity of the effective potential in bidimensional quantum electrodynamics is shown.

5753 **(DOE/ER/03992—564) Proposed geometrizations for unitarity-imposing superalgebras of the field/ghost systems.** Ne'eman, Y. (Tel Aviv Univ. (Israel)). 1984. Contract AS05-76ER03992. 10p. (TAUP—151-83). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001836.

Alternative geometrizations and their interconnections are discussed, in which the auxiliary ghost-fields, required to prove the unitarity of a gauge theory are derived from a geometrical model. The formulation used is that of a ghost-antighost quasi-symmetrized superalgebra. (LEW)

5754 **(DOE/ER/03992—565) Supermanifolds and Berezin's new integral.** Ne'eman, Y. (Tel Aviv Univ. (Israel)). 1984. Contract AS05-76ER03992. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85001833.

Berezin's new integral over a supermanifold is introduced and some of its applications are discussed. Generalized superdifferential exterior forms are outlined. The application of the concept of complementary forms to the integration over a sub-supermanifold is discussed. Commutative differentials are treated as plain commuting variables. The necessary definitions for a scalar product, possibly hermitian, are given. Characteristic classes are discussed. (LEW)

5755 (DOE/ER/03992—566) Search for the equation of an infinite-component world-spinor field. Ne'eman, Y. (Ministry of Science and Development, Jerusalem (Israel)). 1984. Contract AS05-76ER03992. 13p. (TAUP—N153-84). NTIS, PC A02/MF A01; GPO Dep. File Number DE85001834.

The properties of the equation for an infinite-component world-spinor field are discussed. An attempt by Mickelsson modelled on Dirac's equation to construct a field equation for SL(4,R) world spinor is briefly discussed, and is found not to obey the principle of equivalence. Phenomenology of candidate fields are briefly considered. (LEW)

5756 (IC—83/180) Towards a complete QFT treatment of monopole induced baryon number violating transitions. Craigie, N.S.; Nahm, W.; Rubakov, V.A. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700026.

By showing that the radially reduced QCD of s-wave fermions outside the core of a GUT monopole can be treated in a way analogous to 't Hooft's QCD_2 in the large Nsub(c), we are able to give a complete QFT treatment of all the relevant long-range gauge fields outside the monopole core. We prove that the original cluster argument for the existence of baryon number-violating fermion "condensates" around the core gives, in fact, the correct result, despite the neglect of QCD strong interactions, which prevent the propagation of isolated quarks. We discuss briefly how a complete computational framework for a monopole-induced hadron-lepton transition might be derived.

5757 (IC—83/183) Spontaneously broken gauge theories as weakly coupled low energy effective Lagrangians for ASF confining preon gauge theories. Craigie, N.S. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700027.

The link between Lsub(preon) and Lsub(eff) and the question of mass scales are addressed. Topics discussed include the correct way to intepret the global symmetry classification of Lsub(preon) bound states and an approximate gauge symmetry of Lsub(eff), the sense in which a renormalizable Lsub(eff) can emerge from the properties of Lsub(preon), and the price of breaking the L-R symmetry spontaneously in Lsub(preon) through preon condensates. Some examples with a Glashow-Salam-Weinberg SU(2)sub(L)xU(1) structure are given. The prospect for supersymmetric models is elucidated.

5758 (IC—83/210) Kaluza-Klein supergravity in ten dimensions. Huq, M.; Namazie, M.A. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700018.

We construct a massive version of N=2 supergravity in ten dimensions by compactification of the eleven dimensional, N=1 theory. This theory describes the usual N=2 massless super-multiplet, in addition to which there is an infinite tower of massive, charged N=2 supermultiplets.

5759 (IC—83/214) Symmetry properties and dynamics in the gauge theories with scalar fields. Matveev, V.A.; Shaposhnikov, M.E.; Tavkhelidze, A.N. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700028.

The possibility of spontaneous violation of the local and global symmetries in the gauge theories with scalar fields in the fundamental representation is discussed. The general arguments for the fact that the spontaneous violation of the local gauge symmetry is impossible are presented. It is demonstrated that the theory may be formulated in terms of gauge-invariant ("colourless") local fields. Using the electro-weak theory as an example, it is shown that the existence of short-range forces, carried by the massive vector bosons, has nothing to do with the spontaneous symmetry violation, but is entirely due to the nonzero value of the gauge-invariant order-parameter - the vacuum average $<phi^+ phi> = eta$ (the scalar condensate). The results obtained are then generalized to the case of QCD with massless scalar quarks. Using the methods of operator expansion and finite energy sum rules, we come to the conclusion that the two dynamical regimes - with strong and with weak coupling - may exist, depending on the sign and value of the single order-parameter eta. In the case of the strong coupling regime, which takes place at large negative values of scalar condensate, we find that the new family of hadrons with masses of about a few tens GeV may exist.

5760 (IFIN-FT—209-1982) Spectral analysis of the extension of the adjoint representation of a lie algebra to its tensor algebra. I. Second order tensors and gl(n,C). Scutaru, H. (Institutul Central de Fizica, Bucharest (Romania)). Mar 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700167.

A method of computing the projection operators associated to subrepresentations of the natural extension of adjoint representation of a Lie algebra to its tensor algebra has been developed for reductive Lie algebras in the case of second order tensors. These projection operators appear in the spectral analysis of an operator which has been considered by Okubo in connection with the polynomial identities in an irreductible representation. Concrete results are given for gl(n,C), $n >= 4$.

5761 (IFIN-FT—210-1982) New instanton and meron solutions of a generally covariant four-dimensional sigma model. Visinescu, M. (Institutul Central de Fizica, Bucharest (Romania)). Apr 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700168.

We construct new solutions of the four-dimensional sigma model coupled to the metric tensor field and having an internal O(5) invariance. Our solutions interpolate continuously between the known instanton and meron solutions depending upon a parameter f. We find that the typical domain for the instantons is $2 < f <= 3$ while for the merons is $0 <= f <= 2$.

5762 (KFKI—1984-45) Canonical quantization of local field theories. Banai, M.; Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700029.

A nonconventional extension of the canonical quantization method for local field theories is presented. Some difficulties of the conventional approach are avoided, e.g. there are no divergencies in the corresponding S-matrices. 13 refs.

5763 (KFKI—1984-47) Non-local charged fields and the phases of the Z(2) Higgs model. Szlachanyi, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700030.

Non-local order parameters are constructed to test confinement, deconfinement and broken charge symmetry phases of lattice gauge theories with matter fields. The relation of these classical fields to the structure of the quantum theory is analyzed. In the case of the Z(2) Higgs model the author explicitely constructs a charged sector in the free-charge phase. The confinement-screening phase turns out to be split into two phases from the stand-point of non-local fields. This phase transition can be interpreted as the breaking of the global gauge symmetry. 9 refs.

5764 (KFKI—1984-63) Finite quantum gravity. Meszaros, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700022.

In case the graviton has a very small non-zero mass, the existence of six additional massive gravitons with very big masses leads to a finite quantum gravity. There is an acausal behaviour on the scales that is determined by the masses of additional gravitons.

5765 (KMU-HEP—83-04(Rev.)) Finite temperature susy GUT phase transitions determined by radiative corrections. Kripfganz, J.; Perlt, H. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700170.

Studying the 2-loop perturbative contribution to the free energy of supersymmetric grand unified theories, SU(3)xSU(2)xU(1) is found to be the prefered low temperature phase. The transition temperature is still within the weak coupling regime.

5766 (LBL—18406) Ultraviolet divergences and supersymmetric theories. Sagnotti, A. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 23p. (CONF-8406212—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001649.

From International school of physics "Enrico Fermi"; Varenna, Italy (18 Jun 1984).

This article is closely related to the one by Ferrara in these same Proceedings. It deals with what is perhaps the most fascinating property of supersymmetric theories, their improved ultraviolet behavior. My aim here is to present a survey of the state of the art as of August, 1984, and a somewhat more detailed discussion of the breakdown of the superspace power-counting beyond N = 2 superfields. A method is also described for simplifying divergence calculations that uses the locality of subtracted Feynman integrals. 74 references.

5767 (NBI-HE—84-10) Monte Carlo meets the fishnet. String formation in a gas of Feynman diagrams. Greensite, J. (Niels Bohr Inst., Copenhagen (Denmark)). Mar 1984. 69p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703355.

It is likely that the quark confinement mechanism at large N should be understood purely in terms of high-order planar Feynman diagrams; in particular, the center of the gauge group can play no role whatsoever. The author considers the diagrammatic expansion of loop integrals in planar wrong-sign phi4 theory. It is shown that the sum of all fishnet diagrams contributing to the loop can be expressed as the grand partition function of an unusual gas, whose dynamics can be simulated on a computer. The 'molecules' of this gas correspond to vertices of the position-space diagrams, the molecular interactions are determined by the propagators, and the coupling constant plays the role of a chemical potential. The most remarkable feature of this gas is the existence of a critical coupling gsub(c), where string formation takes place. As g → gsub(c) the fishnet vertices tend to cluster around the minimal surface of the loop, thereby forming a string. The role of asymptotic freedom in bringing the coupling to the critical point, and the connection to the Polyakov string, are also discussed. In the Hamiltonian formulation, a very straightforward explanation of quark confinement is presented.

5768 (RAL—84-042) Effective Lagrangian for the pure super Yang-Mills theory derived from renormalization group considerations. Chang, C.; Chou, K.; Dai, Y. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700031.

Further comments and analysis are made on the derivation of the effective Lagrangian for the N=1 pure super Yang-Mills theory from renormalization group considerations and on the implications of results obtained.

5769 (TRI-PP—84-41) Harmonic expansions for (4+K) dimensional Rarita-Schwinger fields on coset spaces and effective Lagrangian in four dimensions. Fogleman, G.; Viswanathan, K.S. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Simon Fraser Univ., Burnaby, British Columbia (Canada)). Jul 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900218.

Harmonic expansions on the internal compact coset manifold G/H for the (4+K) dimensional Rarita-Schwinger (R-S) fields are developed. The dimensional reduction of the R-S Lagrangian coupled to gravity in (4+K) dimensions is carried out using these expansions. The resulting four-dimensional effective Lagrangian describes an infinite tower of massive spin 3/2 and spin 1/2 fields, coupled minimally and nonminimally to gauge fields. The masses of the Dirac fields are not given by the eigenvalues of the internal Rarita-Schwinger operator as is usually supposed.

5770 (UWThPh—84-26) Proton decay in grand unified theories. Lucha, W. (Vienna Univ. (Austria)). 1984. 80p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85700032.

Interactions which violate the conservation of baryon and lepton number represent an intrinsic part of all grand unified theories (GUTs) of strong and electroweak interactions. These new interactions - predicted within the framework of GUTs - generate B and L violating four-fermion interactions via the exchange of superheavy particles which cannot be ascribed a well-defined baryon or lepton number. The effective coupling constant of these four-fermion interactions might be large enough to make the proton decay detectable by the present generation of experiments. In this review the basic concepts of conventional as well as supersymmetric GUTs relevant for proton decay are sketched. The baryon number violating sector of grand unified theories is discussed in more detail. Special emphasis is laid on the various selection rules arising as consequences of low-energy gauge invariance and supersymmetry for proton decay. These selection rules already determine the coarse pattern of the resulting decay modes and branching ratios without any reference to or detailed knowledge of the underlying grand unified theory. Finally the numerous theoretical predictions are summarized and confronted with experiment.

5771 (UWThPh—84-33) 'Equivalent' potential to SVZ moments to order $<G^4>$. Bertlmann, R.A. (Vienna Univ. (Austria)). 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700033.

We extend the 'equivalent' potential of Bell and Bertlmann on the basis of field theory by accounting for operators of dimension 6 and 8. There is no sign of flavour smoothening. The discrepancy between Schroedinger result and moment result improves but is still present. The moment result remains remarkably stable.

5772 (UWThPh—84-36) Supersymmetric vector particles. Rumpf, H. (Vienna Univ. (Austria)). 1984. 41p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700016.

It is shown that a relativistic generalization of Witten's supersymmetric quantum mechanics yields the Proca field equations describing a spin one particle, and, in the massless case, the Maxwell equations and the Lorentz gauge condition. The generalization is based on a representation of the pseudoclassical complex Grassmann variables by rectangular rather than quadratic matrices at the quantum level and on a non-associative operator product. We study all possible supersymmetric couplings to external fields. These include scalar, vector and tensor fields. The couplings exhibit a quadrupole characteristics of the pseudoclassical particle. In particular the coupling to an external vector field may be formulated in a purely geometrical manner and interpreted as that of a pure electric quadrupole to the Maxwell field. The corresponding Schroedinger equation does therefore not obey the minimal coupling prescription. The tensor field may represent not only a Riemannian, but also a complex hermitian metric. In the Riemannian case the quantization prescription entails the well-known covariant generalization of the classical vector field equations. We also derive a classical limit of the quantum theory that involves only real numbers. Finally we speculate on the existance of na analogous non-standard quantization for extended supersymmetric field theories.

5773 (WIS-PH—83/31) Domain walls. Horizontal epilogue. Davidson, A.; Vozmediano, A.H. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Jul 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703356.

Pointing out that the domain wall problem is actually empty at the SU(3)xSU(2)xU(1) single-generation level, horizontal Peccei-Quinn mechanism emerges as a necessary grand unified multigenerational ingredient in the absence of bizarre gauge interactions and/or exotic fermions. The intergenerational structure dictated by the

uniqueness of the vacuum in invisible axion theories is analysed in detail.

5774 **Geometry, topology, and supersymmetry in nonlinear models.** Curtright, T.L.; Zachos, C.K. (Physics Department, University of Florida, Gainesville, Florida 32611). *Physical Review Letters;* **53**: No. 19, 1799-1801(5 Nov 1984).

Supersymmetric two-dimensional sigma models which include Wess-Zumino topological terms are constructed, analyzed, and interpreted by means of torsion on the field manifold. One-loop renormalization results are presented geometrically, revealing that an infrared fixed point exists when the torsion parallelizes the manifold. The O(4)/O(3) model is used to illustrate general results.

5775 **Comments on the parametrization of the Kobayashi-Maskawa matrix.** Chau, L.; Keung, W. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **53**: No. 19, 1802-1805(5 Nov 1984).

We show that the quark mixing matrix can be parametrized in exactly unitary forms with the imaginary parts present only at the order of 10^{-3}. With s/sub x/ = s/sub l/ and s/sub y/ well determined, measurements of ϵ' or other CP-nonconservation effects can determine s/sub z/s/sub phi/. Then after 'V/sub u/b ≃s/sub z/ is measured, s/sub phi/ is known. We also give a simple expression for the CP asymmetry in the B^0-B-bar ^{0} mixing.

5776 **Calculation of weak transitions in lattice QCD.** Brower, R.C.; Maturana, G.; Gavela, M.B.; Gupta, R. (Institute for Narticle Physics, University of California, Santa Cruz, California 95064). *Physical Review Letters;* **53**: No. 14, 1318-1321(1 Oct 1984).

We propose the use of Monte Carlo simulations of QCD to evaluate hadronic matrix elements of local operators encountered in electroweak and grand-unified-theory transitions. Preliminary Monte Carlo estimates are made of the $\Delta S = 2$ matrix elements responsible for the K/sub l/-K/sub S/ mass difference and the $\Delta S = 1$ operators believed to explain the $\Delta I = (1/2)$ enhancement.

5777 **A monopole search using an accelerator detector.** Connolly, P.L. (Brookhaven National Lab., Upton, NY, USA). pp 617-619 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

This chapter describes the use of a neutrino detector at the Brookhaven AGS to investigate the feasibility of using an already constructed apparatus for Grand Unified Theory (GUT) monopole searches. The detector consists of 112 identical modules, each containing a plane of liquid scintillator cells for event time and 2 planes of proportional drift tubes for xy position measurement. There is a gamma catcher for downstream electromagnetic shower measurement and a muon spectrometer for normalization and beam studies. The lower velocity limit in the study was constrained by the gate width which could be readily extended. It is demonstrated that a large accelerator detector can be operated for a monopole search.

5778 **The scales and upper bounds of classical monopole solutions.** Zachos, C.K. (Argonne National Lab., Argonne, IL). pp 25-28 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

This chapter reports on some observations on the mathematical structure of the classical monopole solutions which may enable an understanding of the structure of the relevant physical objects. The equations of the Grand Unified Theories describing monopoles involve several mass scales which indicate the various gauge bosons and Higgs scalars of these systems. The upper limits are obtained by increasing the concavity of the Higgs potential indefinitely in all group directions, maintaining the Higgs field vacuum values fixed.

5779 **Proton decay: 1982.** Marciano, W.J. (Brookhaven National Lab., Upton, NY). pp 71-94 of Field theory in elementary particles. New York, NY, USA; Plenum Press (1983).

In Georgi-Glashow SU (5) model of proton decay =A, and of the proton lifetime, the predicted minimal was below experimental bound, and thus causes a confrontation between experiment and Su (5) theory. Section II updates experimental values and uncertainties for the gauge couplings of the QCD times WeinbergSalam model. Uncertainties in the fine structure constant alpha, are updated. In section III the SU (5) renormalization group analysis of Georgi, Quinn, and Weinberg is reviewed. Predictions for t /SUB p/ are given. Uncertainties in t /SUB p/ caused by proton decay matrix elements, generation mixing, the value of the fourth fermion generation, and nuclear physics effects, are found to be insignificant. Enlarging Higgs scalar sector of the SU (5) model diminishes predictability. In unrestrained scalar masses, the value of t /SUB p/ can become arbitrary. By hierarchy condition the uncertainty can be held at a factor of 10. This demonstrates the importance of pushing experiments in the region of T /SUB p/ about 10^{33} about 10^{33} supersymmetry extensions.

5780 **Monte Carlo computation of the hadrionic mass spectrum.** Rebbi, C. (Brookhaven Natl Lab., Upton, NY). pp 277-292 of Field theory in elementary particles. New York, NY, USA; Plenum Press (1983).

The influence of Monte Carlo simulations on quantum gauge theory studies is reviewed. They have produced substantial evidence for the validity of lattice regularization, and the correctness of QCD as the theory of strong interactions. Monte Carlo results in the lightest masses in the spectrum of a quantized SU (2) or SU (3) gage theory are studied. Pure gauge theory states (glueballs) and coupled gauge and fermionic field states (hadrionic spectrum) are treated. Computation of approximations of the state of the quark model are reviewed. Masses are evaluated from the rate of decay of suitable Green's function. Operators to excite a pure gauge state out of the vacuum, the simplest being the character of the parallel transporter around a plaquette, are examined. Various other operators are studied as well. Quark model states in a theory with fermions, mesonic states excited by operators, and these operators, are examined.

5781 **Superstrings.** Schwartz, J.H. (California Inst. of Tech., Pasadena, CA). pp 193-212 of Field theory in elementary particles. New York, NY, USA; Plenum Press (1983).

Type I superstrings are supersymmetrical open strings whose massless modes belong to the adjoint representation of a Yang-Mills gauge group and singlet closed strings. The interacting theory in ten dimensions is free from ghosts and tachyons and is (at least) one-loop renormalizable. Type II superstrings are supersymmetrical closed strings only. The interacting theory in ten dimensions is also free from ghosts and tachyons and is (at least) one-loop finite. By compactifying six dimensions and letting the radii and Regge slope approach zero, one obtains $N = 4$ Yang-Mills theory as a limit of theory I and $N = 8$ supergravity as a limit of theory II. A power-counting argument suggests that $N = 4$ Yang-Mills theory should be ultraviolet finite to all orders, whereas $N = 8$ supergravity should have ultraviolet divergences starting at three loops.

6455 Scattering Theory

5782 **(IC—83/177) Validity and practical applicability of derivative analyticity relations.** Kolar, P.; Fischer, J. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700079.

We examine derivative analyticity relations (DAR), which were originally proposed by Bronzan as an alternative to dispersion relations and in which the dispersion integral is replaced by a tangent series of derivatives. We characterize the class of functions satisfying DAR, and show that outside this class the dispersion integral represents a Borel-like sum of tangent series. We point out difficulties connected with the application of DAR.

5783 **(IFIN-FT—219-1982) Optimal analytical extrapolations revisite.** Dita, P. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700169.

The problem of optimal analytic extrapolation of holomorphic functions from a finite set of interior data points to an other interior point is completely solved in the general case of data known with unequal errors. Simple and easy to handle algorithms are obtained.

65 PHYSICS. II.

REFER ALSO TO CITATION(S) 6500005565, 5623

6510 Nuclear Physics

5784 **(BNL-NCS—51771) Charged particle nuclear data bibliography. Literature scanned from March 1, 1982-March 31, 1984. First Edition.** Holden, N.E.; Ramavataram, S.; Dunford, C.L. (Brookhaven National Lab., Upton, NY (USA)). Apr 1984. Contract AC02-76CH00016. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002784.

The coverage for this bibliography includes all journals, reports, and other publications scanned between March 1, 1982, and March 31, 1984. The bibliography is divided into three sections: references, Target Index, and Residual Index. Retrievals may be obtained from this bibliography using the Nuclear Structure References computer file, based on target nucleus, incident particle, outgoing particles or reactions, residual nuclide, topic, or any combination of these. (WHK)

5785 **(DOE/ER/10332—13) Investigations of the structure and electromagnetic interactions of few-body systems. Progress report, September 1, 1983-August 31, 1984.** Harper, E.P.; Lehman, D.R.; Prats, F. (George Washington Univ., Washington, DC (USA). Dept. of Physics). 26 Sep 1984. Contract AS05-79ER10332. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002854.

The George Washington University nuclear theory group proposes to conduct investigations of the structure and electromagnetic interactions of few-body systems. The structural properties of the very light nuclei are examined by developing theoretical models that begin from the basic interactions between the constituents and that are solved exactly (numerically), i.e., full three or four-body dynamics. Such models are then used in an attempt to understand the details of the strong and electromagnetic interactions of the few-nucleon nuclei after the basic underlying reaction mechanisms are understood with simpler models. Examples of specific work proposed are the following: (1) From exact four-body dynamics, derive the equations that will permit calculation of the $^4He \rightarrow {}^3He + n$ and $^4He \rightarrow d + d$ asymptotic normalization constants; (2) Develop a unified picture of the $p + d \rightarrow {}^3He = \gamma$, $p + d \rightarrow {}^3He = \pi^0$, $p + d \rightarrow {}^3H + \pi^+$ reactions at intermediate energies; (3) Calculate the elastic and inelastic $(1^+ \rightarrow 0^+)$ form factors for ^6Li with three-body (αNN) wave functions; (4) Calculate static properties (RMS radius, magnetic moment, and quadrupole moment) of ^6Li with three-body wave functions; and (5) Develop the theory for the coincidence reactions $^6Li(p,2p)n\alpha$, $^6Li(e,e'p)n\alpha$, and $^6Li(e,e'd)\alpha$. It is anticipated that these efforts will expand the frontiers of our knowledge about few-body nuclei.

5786 **(DOE/ER/40101—1) Duke nuclear theory progress report 1984 and outline of further research. Period of performance, December 1, 1983-November 30, 1984.** Cusson, R.Y. (Duke Univ., Durham, NC (USA). Dept. of Physics). 1984. Contract AS05-83ER40101. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003238.

Brief progress summaries are given on the following studies: $(\gamma,p)/(\gamma,n)$ ratio in ^4He; shell model treatment of (0 and 1) hw states in A = 4-16 nuclei; continuum shell model calculations for ^{14}C; very large nuclear physics numerical calculations; quasi-molecular states in light nuclei; and relativistic mean-field dynamics applied to $^{16}O + {}^{16}O$ scattering. (WHK)

5787 **(JINR-D—3,4-82-704, pp 7-24) Fifty years of neutron physics.** Frank, I.M. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

A survey of neutron physics achievements during fifty years of its development beginning from neutron discovery in 1932 has been given. A complex of experimental and theoretical data collected by soviet and foreign laboratories in the nucleus fission physics has been considered retrospectively. Neutron methods of nucleus investigation have been described. Theoretical and experimental problems of reactor physics and technique arising during the chain nuclear process investigation have been discussed. Up-to-date problems of neutron physics have been considered in detail. A variety of neutron properties and spheres of neutron physics application have been noted.

6511 Experimental Techniques

5788 **(INFN/AE—82-2) Trinuc: a fortran program for the identification, and the energy and momentum determination of the light charged particles (p,d,t) and neutrons emitted after the absorption at the rest of negative pions in light nuclei.** Rui, R. (Istituto Nazionale di Fisica Nucleare, Trieste (Italy)). 1982. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85700173.

Energy, momentum and missing mass spectra, angular distribution of two particles (n,n), (p,p), (n,d) and (n,t) detected in coincidence experiments, have been calculated with this program. At this moment only π^- absorption reactions on ^{12}C nuclei have been studied, even if the program is adaptable to execute these calculations for any kind of target nucleus. The $\pi^- + {}^{12}C$ experiment was performed at the triumf meson facility - Vancouver B.C., Canada -, under the supervision of prof. C. Cernigoi. The instrumental apparatus used to perform the experiment consisted of a beam telescope (ref. 1), of four large plastic counters NC (ref. 2) and of a large telescope plastic counter RT (ref.3). The tecniques of time of flight (TOF) (only for charged particles) have been used to deduce the energy and identify the mass of the detected particles.

5789 (INS-PH—2, pp 5-17) **Experiments at INS electron synchrotron.** Kato, Sadayuki (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

Photoproduction of pion and proton on nuclei in 1 GeV energies region are discussed in order to study the nuclear structure. We illustrate how those reactions can be used to obtain information on short range nature of the pion wave function and on nuclear wave functions. Also we discuss about the dibaryon resonances and the deutron wave function.

5790 (INS-PH—2, pp 103-112) **(γ,p) reaction and nucleon correlations inside nucleus.** Maruyama, K. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

Photons have an advantageous character of having the chance to see all the nucleons inside the nucleus equally. Uncountable numbers of experimental studies on (γ,p) reaction have been made to investigate the intra-nucleus nucleon correlations over the past three decades. Recent experiments using the tagged photon beam have clarified the existance of photo-absorption mechanism by two nucleon system inside the nucleus. A brief review of these works is given. Some qualitative proposals for possible photo-nucleus experiments in future are also roughly depicted.

5791 (INS-PH—2, pp 116-122) **Photon tagging system LNSTU.** Terasawa, T. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

A research project on intermediate energy photo-nuclear physics now in progress at LNSTU is reported. The objectives of the project are discussed.

5792 (JINR—D-3,4-82-704, pp 145-180) **Nuclear spectroscopy problems studied with neutrons.** Raman, S. (Oak Ridge Y-12 Plant, TN (USA)). 1982. NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

Recent advances in the time-of-flight spectroscopy, as well as in the gamma ray spectroscopy following neutron capture and research program at the Oak Ridge Electron Linear Accelerator (ORELA) are considered. The purpose of this studies is to measure, analyze, and interpret neutron cross sections, principally of encriched isotopes, for basic nuclear physics information and also to respond to applied cross section needs for fission and fusion reactors. The emphasis at ORELA experiments is made on nucleosynthesis and demivation of optical model parameters. By going to new energy domains by using polarized beams and targets, through the invention of new kinds of detectors, and through the general improvement in beam quantity and quality, new features of nuclear structure and reactions have been obtained.

5793 (LBL—18475) **Broadband excitation in nuclear magnetic resonance.** Tycko, R. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 292p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85003522.

Theoretical methods for designing sequences of radio frequency (rf) radiation pulses for broadband excitation of spin systems in nuclear magnetic resonance (NMR) are described. The sequences excite spins uniformly over large ranges of resonant frequencies arising from static magnetic field inhomogeneity, chemical shift differences, or spin coupling, or over ranges of rf field amplitudes. Specific sequences for creating a population inversion or transverse magnetization are derived and demonstrated experimentally in liquid and solid state NMR. One approach to broadband excitation is based on principles of coherent averaging theory. A general formalism for deriving pulse sequences is given, along with computational methods for specific cases. This approach leads to sequences that produce strictly constant transformations of a spin system. The importance of this feature in NMR applications is discussed. A second approach to broadband excitation makes use of iterative schemes, i.e., sets of operations that are applied repetitively to a given initial puise sequences, generating a series of increasingly complex sequences with increasingly desirable properties. A general mathematical framework for analyzing iterative schemes is developed. 115 references.

5794 (UTNL-R—0122, pp 70-77) **TOF experiments at Tohoku University.** Kanda, Kazutaka (Tohoku Univ., Sendai (Japan). Faculty of Engineering). Feb 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780068.

In Report of the Technical Research Committee in time of flight experiments, 1980 and 1981.

The TOF experiments have been carried out at Tohoku University. Pulsed proton or deuteron beam is generated by a Dynamitron accelerator. The pulse width is about 2 ns. Neutrons are generated through the reactions of Li-p, T-p, D-D and T-p. The spectrum measurement has been made by using a NE-213 detector. The double differential neutron emission cross section (DDX) experiments have been carried out for the samples of Nb-93, Al-27, Li-7, Be, C, Ti, Mo and Th. The prompt neutron spectra from Th-232 was also measured. The leakage neutron spectra from the assemblies of Li and C were observed. The total cross section of Th-232 was also measured. The use of pulsed neutrons can reduce the effect of room scattered neutrons, and the response function measurement of the NE-213 detector was made for this reason. The measurement of the fission cross section of Np-237 with a BF_3 counter was performed by using pulsed neutrons. The measurement of time dependent neutron spectra and the n-gamma discrimination measurement were able to be made by using pulsed neutrons.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 6512105716, 5796, 5804, 5808, 5838

5795 (IC—83/223) **Breathing mode effect in p-^{4}He elastic scattering at intermediate energies.** Ahmad, I.; Singh, S.K. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700081.

Effect of the coupling between the ground and the first excited monopole state in intermediate energy p-^{4}He elastic scattering has been estimated using the breathing mode model and has been found to be important beyond the first diffraction minima.

5796 (IFIN-HE—101-1981) **Energy dependence phase shift analysis of PI^{4}He elastic scattering and the possibility of the (PI^{4}He) excited states existence.** Nichitiu, F.; Falomkin, I.V.; Sapozhnikov, M.G.; Shcherbakov, Yu.A.; Piragino, G. (Institutul Central de Fizica, Bucharest (Romania)). Jun 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700171.

In the 24 MeV-260 MeV kinetic energy interval, the energy dependent phase shift analysis of π^4He elastic scattering is done. The eneray dependence is given by the rational fraction approximants of the partial S matrix. The search for the stable S matrix zero-pole pairs in the k and $\sqrt{s}$ complex plane give some proofs for the existence of the (π^4He) excited states in the S, P and probably D partial waves.

5797 (INFN-LNF—82-27(CR)) **Elastic scattering of πsup(+-)-mesons on ^{4}He and ^{3}He (experimental data).** Albu, M.; Angelescu, T.; Antonova, M. ; Balestra, F.; Bossolasco, S; Bussa, M.P. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). 1982. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700174.

The differential cross sections of the elastic scattering of π^- mesons on ^{4}He at 68, 98, 120, 135, 145, 156, 174, 208 MeV, of π^+ mesons on ^{4}He at 68, 98, 120, 135, 145, 156 MeV, of π^- mesons on ^{3}He at 68, 98, 120, 135, 145, 156, 180, 195, 208 MeV, of π^+ mesons on ^{3}He at 68, 98, 120, 135, 145, 156 MeV have been measured at the synchrocyclotron of the JINR of Dubna. The energy behaviours of the total elastic scattering cross sections have been deduced. The results are in good agreement with those obtained in other (π^-).

5798 (INS-NUMA—36, pp 1-5) **Contribution of exchange current to magnetic form factor of He-3.** Katayama, Toshiyuki (Hokkaido Univ., Sapporo (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Motivated by the fact that the state of the experimental data on the magnetic form factor of He-3 has become very good of late, the objective of this topic is to consider on the comparison of experiment and theory from the viewpoint of the contact point of three body and four body problems and intermediate energy nuclear physics, and especially, to discuss the result on the effect of meson exchange current. As such object, there is electric form factor heretofore, accordingly its present status is outlined. The importance of three or four nucleon system is the system which can be solved with realistic two-body nuclear force, namely it can be discussed by using the accurate wave function of the system. From there, the demand of understanding deeply the reality and dynamics of various physical mechanisms has newly arisen. It is shown that the analysis of the magnetic form factor of He-3 also is to offer such subject. At the time of evaluating exchange current, the author showed that most of the problems of the second maximum of CFF were able to be solved by only considering the main exchange current. It is noteworthy in the MFF of He-3 that the first minimum and the second maximum were observed, and the maximum q^2 was 32 fm^{-2}. The examination by impulse approximation and the contribution of exchange current are discussed.

5799 (INS-NUMA—36, pp 73-76) **Λ and Σ well depth.** Satoh, Eiji (Chiba Keizai College (Japan)). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

The Λ well depth was calculated by taking into account the effect of the ΛΣ conversion. Takahashi et al. obtained the separate type of potentials which described the hyperon-nucleon interaction up to p waves. Two types of the potentials among several types they obtained were used to calculate the Λ well depth. The G matrix was easily calculated, and the Λ well depth was obtained by integrating the G matrix in momentum space up to the Fermi surface. The effect of the ΛΣ conversion was given by an equation. The total Λ well depth was estimated to be 9.13 MeV and 49.36 MeV for each type of potential, respectively. It was concluded that the argument by Bodmer et al. was not correct. The Σ well depth was also calculated using the potential obtained by Takahashi et al. for I = 1/2 and the one obtained by $\Sigma^+ p \rightarrow \Sigma^+ p$ scattering data for I = 3/2. The obtained value 35.30 MeV may be overestimated, and the experimental value is expected to be in the range from 20 MeV to 30 MeV.

5800 (INS-NUMA—36, pp 22-26) **Large angle elastic scattering of pions by nuclei with Δ hole model.** Sakamoto, Hiroshi (Hiroshima Univ. (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Recently, in the experiment on the elastic scattering of pions by nuclei, the differential cross section has become measurable up to large angle with high accuracy. The behavior of the differential cross section at large angle seems to depend not only on the reaction mechanism, in particular the high order effect of optical potential, but also on the high momentum component of the wave function of nucleons. Concerning the former, the Δ hole model has succeeded in the consistent treatment. Therefore, it was attempted to explain the behavior of differential cross section up to large angle, using this formalism and by improving the wave function of nucleons. The main features of the Δ hole model for the nucleus-scattering of pions are enumerated. It was attempted to form the wave function of nucleons which can reproduce the charge form factor up to the region of higher momentum transfer, and the wave function to satisfy the requirement was obtained. Special attention was paid to form a dip around $q^2 = 10$ fm^{-2} in the charge form factor. The result of calculating the differential cross section using the new single particle wave function is shown. The experimental values of the differential cross section were able to be reproduced well, using the new wave function.

5801 (INS-NUMA—37, pp 23-29) **Effect of short-range repulsive core on ΛN interaction.** Sato, Eiji (Chiba Keizai Junior College (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

The phenomenological study on the interaction of hyperons and nucleons is described. It is assumed that the ΛN interaction can be expressed by the S state. The scattering amplitude is obtained from the given potential. The parameters in the form factors and the potential are determined to reproduce the values of scattering parameters. The one particle potential must be self-consistent. The effective mass of Λ particles and the Λ well depth are obtained. It can be said from the present study that the calculation on the basis of constant energy difference between intermediate and initial states is not proper, and the calculation with no difference does not make much trouble when the potential includes only the attractive force. As the repulsive force is stronger, the effect due to the energy difference is larger. The effect of the short-range repulsive core results in extracting the repulsive force of about 10 MeV.

5802 (INS-NUMA—37, pp 104-111) **Effects of NN and ΛN tensor forces on Λ-separation energies of s shell hypernuclei.** Niimura, Masaharu (Hokkaido Univ., Sapporo (Japan). Faculty of Science). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

In this paper, the effects of NN and ΛN tensor forces are described from the phenomenological viewpoint. The wave function of the system was given from the theory of multiple scattering. The Hamada-Johnston potential added with an effective two-body force, which represents the effect of three-body force, was used for the nuclear potential. The Dalitz type central force was used for the ΛN potential. The intensity of the tensor force was adjusted to reproduce the mixing parameter derived by OBEP. The results of analysis were as follows. When the H-J potential was used, the binding energy of Λ particles in hyper He-5 became close to the experimental value. The effect of the tensor forces is clear. A large spin dependent force is required to reproduce the excitation energy of hyper He-4. The ΛN tensor force reduces the excitation energy. The contribution of OPE type CBS component to the difference of the binding energy between hyper He-4 and hyper H-4 was consistent with the experimental results when the ΛN tensor force was present, and its sign was negative. The contribution of the tensor part was the main contribution. The large spin independent CSB component was required to reproduce the energy difference of the ground state of hypernuclei and the excited state of hypernuclei.

5803 (INS-NUMA—37, pp 116-121) **Variation calculation of the Λ + d system.** Hasegawa, Kenji (Fukui Univ. (Japan). Faculty of Engineering). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

The calculus of variation was applied to solve the equation for the Λ-d relative wave function. The trial wave function was a product of an accurate wave function of deuterons, the correlation functions between Λ and nucleons, and an adjustable function F(R). The function F(R) was determined from the equations for bound state, and zero energy scattering. The calculus of variation was applied to solve these equations. The potential used by Dalitz was used as the potential between particles. The binding energy and the Λ-d scattering parameters were obtained. The low energy scattering cross section was calculated. As the results of analysis, it was found that the calculus of variation was able to be successfully applied.

5804 (INS-PH—2, pp 39-44) **Phenomenological analysis of the γd → pn process.** Takeuchi, Y. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

The target asymmetry T(theta) in γd → pn has been measured at the photon energies between 300 and 700 MeV. The results show relatively small values. A phenomenological analysis has been made with non-resonant amplitudes calculated in the covariant formalism. Including the dibaryon resonances, the analysis reproduces the data on dσ/dohm, P(theta), Σ(theta) and T(theta) rather well.

5805 (INS-PH—2, pp 84-88) **Elastic pi-d scattering and dibaryons.** Kubodera, K. (Jochi Univ., Tokyo (Japan). Dept. of Physics). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

The possible influences of dibaryons on the spin observables in elastic pi-d scattering are reviewed.

5806 **(JINR—R-1-83-565) Azimuthal correlations and dibaryon states in the ^{4}Hep → dppn reaction.** Zelinski, P.; Sobchak, T.; Stehpanyak, I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703237.

The correlation of the nucleon pairs in the ^{4}Hep → dppn reaction is analysed over their relative azimuthal angles. The experiment has been realized on the synchrophasotron by means of the 1 m hydrogen bubble chamber. It has been found that the studied reaction mainly goes through double interaction. The different behaviour of the azimuthal asymmetry in the direct channel and charge exchange channel is in good agreement with the supposed important role of the Δ_{33}N interaction. The reinforcement of the azimuthal correlation in the peak area of the two-proton effective mass distribution at M=2035 and M=2137 MeV/c^2 witnesses in favour of the dibaryon states.

5807 **(JINR—R-2-83-749) Six-group-admixture in the form factor of the ^{3}He nucleus at large transfer momenta.** Burov, V.V.; Luk'yanov, V.K.; Titov, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703373.

Elastic form factor of the ^{3}He nucleus is analysed with the use of Gaussian-type and realistic nuclear wave functions with taking into account of a contribution of six-quark admixtures. The latter has been chosen so as to describe the data of analysis of cumulative and other processes and it amounts to about 8%. It is shown that unlike the deuteron form factor for ^{3}He the quark-nucleon interference is essential. The six-quark admixture does not remove the second minimum in the form factor of ^{3}He as a three-nucleon system at momentum transfer square q^2 approximately 50 fm^{-2}. The comparison with other theoretical models and available experimental data is performed.

5808 **(KIYI—83-23) Study of the ^{1}H(d,pp)n reaction at deuteron low energies.** Zatekin, V.V.; Kondrat'ev, S.N.; Popova, A.M. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1982. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703388.

Differential cross sections were measured for the H' (dn pp)n reaction in the kinematic region where neutron in the final state is in rest in the c.m.s. The measurements were performed at the deuteron energy of 12.8; 14.2 and 15.6 MeV. Theoretical analysis of the experimental data was carried out with the Faddeev equation solution with the separable Yamaguchi potential for charge-dependent, charge-independent forces and "hybrid" approximation. The charge-dependent force model calculations considering effectively the Coulomb interaction of both protons agree with the experimental results, contrary to the charge-independent force model. The "hybrid" approximation seemed to be inadequate to many kinematic regions of the reaction. No anomalies were observed in behaviour of the deuterons break up reaction in the kinematic region of zero neutron energy in c.m.s.

5809 **(LA-UR—84-3378) LAMPF Nucleon-Nucleon Program.** van Dyck, O.B.; McNaughton, M.W. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-8409162—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002420.

From 6. international symposium on high energy spin physics; Marseille, France (12 Sep 1984).

NN activities at LAMPF are summarized. Measurements with p+p are now focusing on inelastic spin transfer and spin correlations. There should be good coverage of np spin correlations by 1986. Additional facilities are outlined for polarized beam nucleon and nuclear physics. 15 references.

5810 **Tensor-polarized—deuteron capture on deuterium and the D state of ^{4}He.** Weller, H.R.; Colby, P.; Roberson, N.R.; Tilley, D.R. (Duke University, Durham, North Carolina 27706 and Triangle Universities Nuclear Laboratory, Duke Station, Durham, North Carolina 27706). *Physical Review Letters;* **53**: No. 14, 1325-1328(1 Oct 1984). Contract AC05-76ER01067.

The tensor analyzing power $T_{20}(\theta)$ of the reaction ^{2}H(d,γ) ^{4}He has been measured at six angles at E/sub d/ = 9.7 MeV. The result is found to be isotropic with a value of T_{20} = -0.22 +- 0.014. This analyzing power arises from the interference of S = 0 and S = 2 capture amplitudes. Since the reaction proceeds predominantly via E2 radiation, the S = 2 capture strength can be attributed to S = 2, L = 2 ground state admixtures. A heuristic model calculation has been used to show that a 4.8% D-state admixture in the two-deuteron wave function describing ^{4}He can account for the observed T_{20}.

6513 Nuclear Properties And Reactions, A=6-19

5811 (CONF-8403101—, pp 13-15) **Study of ^{11}B + ^{12}C and ^{10}B + ^{13}C fusion cross sections.** Mateja, J.F.; Frawley, A.D.; Kovar, D.G.; Henderson, D.; Ikezoe, H.; Janssens, R.; Rosner, G.; Stephans, G.; Wilkins, B.; Lesko, K. (Tennessee Technological Univ., Cookeville). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

In an effort to understand the mechanism responsible for fusion cross section limitations in light heavy-ion systems, four entrance channels which form the ^{23}Na compound nucleus have been studied. A limitation mechanism based on a critical density of compound nucleus states does not appear to be responsible for the fusion cross section limitation at energies from approximately one to three times the Coulomb barrier energy. The possibility exists, however, that such a process becomes important at higher energies. To address this question, measurements which utilize the Argonne tandem-linac accelerator have now been completed in the energy range 42.5-80.9 MeV for the ^{11}B + ^{12}C and the ^{10}B + ^{13}C. The preliminary findings of this work are reported here.

5812 (CONF-8403101—, pp 97-100) **Observation of a critical angular momentum for deep inelastic processes with light heavy ions.** Thornton, S.T.; Parks, R.L.; Shapira, D.; Schull, D.; Ford, J.L.C. Jr.; Shivakumar, B.; Gomez del Campo, J. (Univ. of Virginia, Charlottesville). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract W-7405-ENG-26.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

^{28}Si beams at several energies ranging from 100 MeV to 190 MeV from the Brookhaven National Laboratory Tandem facility were used to bombard natural carbon foils, and spectra of recoiling target-like nuclei were studied at forward angles. The most probable Q value (Q) for these spectra does not depend on the angle of emission and has a linear dependence on bombarding energy over the energy range 30 < E/sub cm/ < 40 MeV. Results from similar measurements at higher energies are shown for emitted carbon and oxygen nuclei, the two strongest outgoing channels. The most probable values for the total kinetic energy of the final fragments as a function of bombarding energy is given. The kinetic energies were obtained by adding the most probable values of the measured Q value spectra to the center-of-mass bombarding energy (E/sub kin//sup f/ = E/sub cm/ + Q). The linear dependence on bombarding energy seen at the lower energy range arises from the centrifugal energy of the rotating dinuclear system prior to scission. Above an incident energy of 45 MeV (c.m.) it is seen that the final kinetic energy becomes almost independent of bombarding energy.

5813 **(DOE/ER/03948—16) Pion interactions at medium energies. Progress report, February 1, 1984-January 31, 1985.** Mayes, B.W.; Hungerford, E.V. (Houston Univ., TX (USA). Dept. of Physics). Oct 1984. Contract AS05-76ER03948. 145p. (ORO—3948-16). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85003422.

Our research program has developed into two major thrusts. The first uses kaons produced at the Brookhaven National Laboratory (BNL) Alternating Gradient Synchrotron (AGS) to study the properties of hyperons embedded in nuclear matter. Specifically we have had under investigation for some time the spectra of both lambda and sigma hypernuclei and the extraction of the hyperon-nucleon interaction parameters. The second thrust uses antinucleons

produced by the AGS to study the antinucleon nucleon interaction and the properties of the annihilation reaction. Both thrusts have an approved program at the AGS which will last several years. Experiments are listed and abstracts of current research are given. Some preliminary results from experiments are presented, and new approved proposals are detailed. (WHK)

5814 (INFN/BE—83-9) **Carbon fragmentation data from 37 and 40 MeV proton bombardment.** De Leo, R.; D'Erasmo, G.; Pantaleo, A.; Paticchio, V.; Variale, V.; Micheletti, S.; Pignanelli, M. (Istituto Nazionale di Fisica Nucleare, Bari (Italy)). 1983. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700182.

Experimental results reported are obtained in the study of fragmentation reactions induced by 37 and 40 MeV protons on carbon. Cross sections obtained are shown. Details of experimental method are also given. No attempt is made to analyse the results in the framework of nuclear models and reaction mechanism, due to the fact that these studies are in progress up to now.

5815 (INS-NUMA—36, pp 15-18) **(γ, π) reaction in C-13.** Sato, Toru (Osaka Univ., Toyonaka (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Recently, experimental research was carried out on the angular distribution of (γ, π^+) reaction in p shell nuclei by Tohoku University group. Here, analysis is performed on C-13 (γ, π^+) B-13 (gr). In the (γ, π^{+-}) reaction, a Kroll-Ruderman term becomes the main term at low energy, and the reaction is a good probe for the research on nuclear structure by sigmatau type excitation. As the treatment of nuclear structure, the analysis of (γ, π) has been carried out, using the transient density adjusting electron scattering phenomenologically. However, all the transient density cannot be determined uniquely, rather (γ, π) reaction and electron scattering give the information on nuclear structure complementarily. Here, how the effect of core polarization studied in detail in electron scattering works in the (γ, π) reaction is investigated. The contribution of exchange current is small in both M1 and E2, and core polarization plays a main role in the region of the momentum transfer of high electromagnetic form factor. The effective Hamiltonian of (γ, π) and the nuclear model adopted are explained. To the angular distribution of C-13 (γ, π^+) B-13 (gr), in the front part, M1, and in the back part, E2 contributed mainly. The effect of core polarization improved the difference in the back part by reducing E2.

5816 (INS-NUMA—36, pp 27-31) **Isobar-hole model and pion-nucleus reaction.** Hirata, Michihiro (Hiroshima Univ. (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

When the isobar-hole model was applied to the pion-nucleus elastic scattering in (3, 3) resonance energy region, it was very successful. It is natural to attempt the study on the adaptability of this model to inelasticity and reaction. Here, (π, N) reaction, of which the experiment has not been able to be explained systematically, and those which are difficult to be explained among inelastic processes are taken up. On the (π, N) reaction, the systematic experimental data began to appear in (3, 3) resonance energy region, but the theoretical analysis has been limited almost to low energy. Therefore, the theoretical analysis on this region using the isobar-hole model is planned. The method taken by the author et al. is explained. The mechanism of pion absorption was considered, and the wave function of pions was derived. As an example, the integrated cross section in C-12 (π^+, p) C-11 was examined. Four probelms which have not been explained theoretically are taken up. 1) The discrepancy in the ratio of reaction cross section at a certain kinetic energy of pions, 2) charge exchange scattering in (3, 3) resonance energy region, 3) double charge exchange scattering in (3, 3) resonance energy region, and 4) the energy dependence of the ratio of reaction cross section. A theoretical attempt is reported.

5817 (INS-NUMA—36, pp 69-72) **Projectile fragmentation in high energy nucleus-nucleus reaction.** Fujita, Takehisa (Nihon Univ., Tokyo. Coll. of Science and Engineering). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Three topics on the projectile fragmentation region in high energy nucleus-nucleus collision are described. The first topic is the production of neutron rich nuclei. For example, the cross section of the reaction $^{12}C + {}^{12}C \rightarrow {}^{8}He + X$ is about 30 μb, and 30 times of that of the reaction $^{12}C + p \rightarrow {}^{8}He$. This is much larger than the value expected theoretically on the basis of the peripheral production mechanism. The second topic is the recent discovery of the events with very short mean free path of projectile fragments. How to interpret these anomalous events has not been settled. The last topic is the determination of the Fermi momentum distribution of nucleons inside nuclei from the momentum distribution of projectile fragments. Based on the Glauber theory, the spectator component of the cross section is shown to be proportional to the Fourier transform of the wave function of the nucleon inside a nucleus. Because the spectator component dominates the longitudinal momentum distribution of projectile fragments, the momentum distribution of the nucleon inside a nucleus can be determined from the longitudinal momentum distribution of projectile fragments. The analysis of the reaction $\alpha + {}^{12}C \rightarrow {}^{3}He + X$ indicated that the Fermi momentum distribution deviated from the Gaussian form.

5818 (INS-NUMA—37, pp 138-142) **Di - lambpha cluster states.** Motoba, Toshio (Osaka Electro-Communication Univ. (Japan)). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

The lightest (p, n, Λ) closed-shell hypernucleus sub($\Lambda\Lambda$) sup(6)He can be considered as a most likely candidate for the unit of hypernuclear cluster structure. First the internal structure of lambpha, α sub(Λ) = sub($\Lambda\Lambda$) sup(6)He, is investigated by solving the $\alpha + \Lambda + \Lambda$ three-body problem microscopically. The compact h. o. wave function $(0\ s)^6$ is found to be a good description for α sub(Λ). Secondly, by using the fully microscopic GCM, we have demonstrated that di - α sub(Λ) cluster states constitute a characteristic rotational band of $J = 0^+ - 6^+$. The E2 transition rate from particle - stable 2^+ to 0^+ states is predicted to be 2 - order faster than the weak decay rate of this system.

5819 (INS-NUMA—37, pp 122-137) **Studies of structures of Λ-hyper Be nuclei by the microscopic $\alpha + \alpha + n\Lambda$ model.** Ikeda, Kiyomi (Niigata Univ. (Japan). Faculty of Science). Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

This report is a brief review of the studies on the internal structure of Λ-hyper Be nuclei. The Λ-N and Λ-Λ interactions were chosen to explain the coupling energy of the hyper He-5 and the double hyper He-6 nuclei. The structure study of the four Λ-hyper Be nuclei by the molecular orbital model was performed. In the Λ hyper Be-9 nuclei, the Λ particles move around the α-α core. The energy level was obtained on the basis of the molecular orbital model. The results were able to be compared with the experimental values. The ground and excited states of the hyper Be nuclei were analyzed. The molecular orbital model was applied. The wave function was a product of the nucleon part and the Λ particle part. The energy curves as the functions of the distance between the centers of α-clusters were obtained. The curves showed the existence of the stable bound state of each hypernucleus. The coupling energy at the ground state and the energy level of hypernuclei were obtained by using the Hill-Wheeler equation. The electric quadrupole transition probability and the life of the level were also calculated. The obtained B(E2) was close to the values for the collective motion. The variation of structure with increasing number of the hyper particles was seen.

5820 (INS-PH—2, pp 113-115) **Effects of Δ-isobar on high energy photonuclear reactions.** Suzumura, Junichi; Futami, Yasuhiko (Science Univ. of Tokyo, Noda, Chiba (Japan). Faculty of Science and Technology). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

5821 (INS-PH—2, pp 123-126) **Measurement of differential cross section for ^{9}Be(γ,pn).** Kanazawa, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

5822 (JINR—E-1-83-670) **Small-angle correlations of identical particles in carbon-carbon interactions at P=4.2 GeV/c per nucleon.** Akhababian, N.; Bartke, J.; Grishin, V.G.; Kowalski, M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703385.

Two-particle small-angle correlations between negative pions and between protons in all inelastic and "central" carbon-carbon collisions at P=4.2 GeV/c per nucleon have been studied. A comparison of experimental $\pi^-\pi^-$ and pp correlation functions with theoretical predictions has been made. A possible evidence for the existence of two fireballs in C+C interactions at P=4.2 GeV/c per nucleon is presented.

5823 (JINR—R-1-83-571) **Experimental investigation of proton pairs direct knock-out from nuclei by 640 MeV protons.** Nadezhin, V.S.; Petrov, N.I.; Satarov, V.I.; Rozanova, A.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703386.

Direct knock-out reaction of proton pairs (reaction p, 3p) on ^{6}Li, ^{12}C, Al, Cu nuclei has been experimentally investigated at proton energies of 640 MeV. The interest in this reaction is explained by a possibility to produce in this reaction of cumulative protons. The investigation has been performed by means of spark chambers controlled by scintillation telescopes with register emitted protons at angles corresponding to proton scattering by a pair of nucleus protons in the center of mass system at an angle of 118 deg. Experimental data on the spectra of 3-proton total energy, on proton energy spectra, and on measured differential cross sections are presented. It is concluded that the main contribution into the reaction could be given by the diagram of double inelastic scattering with Δ_{33} isobar in the intermediate state.

5824 (PB—84-221183) **Laser-based photoacoustic method for measuring stable isotope ratios. Final report on phase 1.** Walsh, F. (KOR, Inc., Cambridge, MA (USA)). 31 Mar 1982. 37p. NTIS, PC A03/MF A01.

Results are presented of research undertaken to determine the accuracy of a laser-based photoacoustic spectrophone in measuring stable isotope concentrations. A spectrophone, laser, and signal analysis system were assembled with a power supply and frequency-modulating fan. This apparatus was used to measure CO_2 in air and human breath and to verify that measurement of (13)CO_2 is possible in the presence of (12)CO_2. The precision of measurement of (13)CO_2 and (12)CO_2 in these nitrogen/oxygen mixtures was + or - 160 ppm and + or - 250 ppm CO_2 respectively. It is concluded that, with some system improvements, this laser-based instrument might replace the more complex and more costly ratio mass spectrometer.

5825 (TRI-PP—84-55) **Activation measurements of the ^{7}Li(p,n)^{7}Be reaction from 60 to 480 MeV.** D'Auria, J.; Dombsky, M.; Moritz, L.; Ruth, T.; Sheffer, G.; Ward, T.E.; Foster, C.C.; Watson, J.W.; Anderson, B.D.; Rapaport, J. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Indiana Univ., Bloomington (USA); Kent State Univ., OH (USA). Dept. of Physics; Ohio Univ., Athens (USA). Dept. of Physics). Jul 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900291.

Activation measurements of the ^{7}Li(p,n)^{7}Be (g.s. + 0.43 MeV) total reaction cross section have been made at proton energies of 60 to 480 MeV. The energy dependence of the total reaction cross section, σ/sub T/(E), is observed to vary inversely with the incident proton energy up to 480 MeV. These results are consistently lower than those reported earlier by Ward, et al. in the energy range of 100 to 200 MeV, the difference being due to the composite nature (^{7}LiCl) of the targets used in the earlier study. The Lithium Activation, Isospin Clebsch-Gordon Ratio and Monte-Carlo Code methods for determining neutron efficiencies are now in good agreement (+- 10%) up to 200 MeV. 18 references.

5826 (UM-P—84/23) **Discrete ambiguity in the optical potential at 400 MeV and its resolution by spin-rotation data.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700087.

Proton elastic scattering from ^{12}C at 398 MeV is studied in terms of a phenomenological optical potential. It is shown that cross-section and polarization data alone lead to a discrete ambiguity in the potential. The sign of the real central and imaginary spin-orbit term can be changed simultaneously. Measurement of the spin-rotation function resolves this ambiguity.

5827 (UM-P—84/27) **Proton inelastic scattering cannot be predicted from electron scattering results.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700088.

The prediction of proton inelastic scattering based on transition densities determined from electron scattering is critically examined. As an example, for the O_3^+ state in ^{16}O, it is shown that abnormal parity amplitudes prevent an unambiguous prediction, and largely different results can be found for proton scattering while electron scattering results are identical.

5828 (ZfK—520) **Missing spectroscopic strength and microscopic calculations of the background below giant resonances.** Kleinwaechter, P.; Rotter, I. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700183.

The problem of extracting spectroscopic strength from a resonance with fine structure components, arising from underlying levels, is investigated in the framework of the continuum shell model. It is shown that the underlying levels are correlated strongly at the top of resonances due to the unitarity of the S-matrix. This selective nonstatistical behaviour of the underlying levels leads to missing spectroscopic strength in the traditional methods of analysing the data and to a selective transparency at the top of resonances.

5829 **Anomalon production by impulsive excitation in relativistic heavy-ion collisions.** Bayman, B.F.; Ellis, P.J.; Fricke, S.; Tang, Y.C. (School of Physics, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review Letters;* **53**: No. 14, 1322-1324(1 Oct 1984).

We have calculated the excitation energies of projectile fragments produced when relativistic projectiles make peripheral collisions with target nuclei. We find that the excitation energy of the fragment is much greater when the target nucleus is relatively heavy (such as Ag or Br) than when it is light (C or O). This could explain the difference between the results of anomalon searches in nuclear emulsion and plastic detectors.

5830 **The $^{12}C(n,n')3$-alpha cross section up to 70 MeV.** Brenner, D.J.; Prael, R.E. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Science and Engineering;* **88**: 97-101(Sep 1984).

The results of an experiment to measure the $^{12}C(n,n')3\alpha$ reaction in nuclear emulsions up to 35 MeV were reanalyzed, with various corrections made using a previously validated nuclear reaction model. Corrections of up to 27% to the published data were obtained, and the corrected results, suggested as an evaluated set of cross sections, are in agreement with low-energy time-of-flight data and also with the predictions of the nuclear reaction model. Corresponding experimental data at 50 MeV also exist; however, they are considered unreliable and calculated data are recommended above 35 MeV.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 6514105858

5831 (CONF-8403101—, pp 20-22) **Self consistent approach to low energy heavy-ion reactions.** Rhoades-Brown, M.J. (State Univ. of New York, Stony Brook). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Calculations based on a unified reaction model with an optical potential plus a short range absorption potential are presented for the systems $^{32}S + {}^{26}Mg$ and $^{32}S + {}^{24}Mg$. Fusion-fission, elastic and inelastic processes are considered. Barrier penetration is studied and cross sections are calculated in the energy range of 20 to 30 MeV and compared with experimental results. The model has also been applied to $^{16}O + {}^{208}Pb$.

5832 (CONF-8403101—, pp 182-185) **Aspects of particle-inclusive production in nucleus-nucleus collisions at 2.1 GeV per nucleon.** Zwermann, W.; Schuermann, B. (Technische Universitaet Muenchen, Garching, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Some typical aspects of nuclear collisions at the incident energy of 2.1 GeV per nucleon are discussed. In particular, the focus is on proton and kaon inclusive production in the collision Ne on NaF at 2.1 GeV per nucleon where good quality experimental data exist. The study is performed within the framework of a multiple collision approach based on sequences of independent baryon-baryon collisions. The momentum distributions of the baryons (needed later for the calculation of the K^+ inclusive spectra) are determined by use of the almost analytical, parameter-free model of transport theory.

5833 (CONF-8403101—, pp 191-194) **Effect of final state interactions on subthreshold K^- production in heavy-ion collisions.** Ko, C.M. (Texas A and M Univ., College Station). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Recently, experiments were carried out at Bevalac to detect K^- in heavy-ion (Si-Si) collisions at an incident energy of 2.1 GeV/nucleon. The threshold for K^- production in the nucleon-nucleon collision is $\sim$ 2.5 GeV. The observation of K^- at subthreshold energies in heavy-ion collisions implies that more than one projectile nucleon must be involved in converting their kinetic energies into the mass of K^-. This experiment provides therefore the possibility of studying nuclear collective effects, such as Fermi motions, coherent production, and multiple collisions. Preliminary data can be largely explained by conventional rescattering theory.

5834 (CONF-8403101—, pp 131-135) **Velocity distribution of fusion-like products for medium mass heavy-ion systems.** Chan, Y.; Albiston, C.; Bantel, M.; Countryman, P.; DiGregorio, D.; Stokstad, R.; Wald, S.; Zhou, S.; Zhou, Z.; Budzanowski, A. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Reactions between ^{14}N, ^{16}O, ^{19}F, ^{20}Ne, ^{22}Ne, ^{24}Mg projectiles and ^{24}Mg, ^{26}Mg, ^{27}Al, ^{28}Si, ^{40}Ca, ^{58}Ni, ^{60}Ni targets have been studied at 7-20 MeV/nucleon. The velocity distribution of nuclear fragments was measured in order to infer the velocity of the compound nucleus prior to decay. The dependences of the distribution on projectile energy and projectile type were obtained. Obtaining cross sections for reaction processes from the data is discussed.

5835 **(IC—83/203) ^6Li elastic scattering.** Khallaf, S.A.E.; Elattar, A.L.; El-Azab Farid, M. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700080.

The folded optical potentials for ^6Li projectiles have been revealed using the Watanabe procedure and two different cluster structures; $^6Li = {}^4He + {}^2H$ and $^6Li = {}^3He + {}^3H$. The calculated potentials are used to generate the elastic scattering differential cross-sections from ^{12}C, ^{40}Ca, ^{24}Mg, ^{28}Si and ^{90}Zr targets at different incident energies (13-63 MeV). Break up correction terms are calculated and added to the folded potentials of the above mentioned structures. The effect on the cross sections is calculated. A correction term to the incident energy due to internal motion of the cluster constituents is considered and its effect on the cross sections is investigated.

5836 **(JINR—E-4-83-680) Description of g/ant multipole resonances in spherical nuclei.** Nguyen Dinh Dang; Ponomarev, V.Yu.; Solov'ev, V.G.; Stoyanov, Ch.; Voronov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703372.

The characteristics of the isoscalar quadrupole resonances in some nuclei are calculated within the quasiparticle-phonon nuclear model. This model is compared with the nuclear field theory. The influence of the Pauli principle corrections in the two-photon components of the wave functions on the resonance characteristics is established.

5837 **(LA-UR—84-2819) PS187 - a good statistics study of antiproton interactions with nuclei: preliminary results.** Sunier, J.W.; Bol, K.D.; Clover, M.R.; DeVries, R.M.; DiGiacomo, N.J.; Kapustinsky, J.S.; McGaughey, P.L.; Smith, G.R.; Sondheim, W.E.; Buenard, M. (Los Alamos National Lab., NM (USA); Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Fribourg Univ. (Switzerland)). 1984. Contract W-7405-ENG-36. 7p. (CONF-840795—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002019.

From 7. European symposium on antiproton interactions; Durham, UK (9 Jul 1984).

The goals of LEAR experiment PS187 are reviewed. The current status of the experiment is discussed, and final data on a search for anti p-nucleus bound states formed by the reactions ^{28}Si(anti p,p) and ^{28}Si(anti p,d) are presented.

5838 **(UM-P—84/21) Isoscalar monopole and dipole transition matrix elements from inelastic alpha scattering.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700085.

Using an implicit folding procedure, isoscalar monopole and dipole transition matrix elements are expressed in terms of deformation parameters and moments of the optical potential for α-scattering. Application to monopole states in light nuclei gives good agreement with data determined electromagnetically. For isoscalar dipole states, the method gives information on $\langle r^3 \rangle$ matrix elements which cannot be obtained otherwise.

6515 Nuclear Properties And Reactions, A=39-58

5839 (CONF-8403101—, pp 23-27) **Nearside/farside decomposition of heavy ion elastic scattering amplitudes.** McVoy, K.W. (Univ. of Wisconsin, Madison). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Interference phenomena occuring in heavy ion elastic scattering reactions are considered. The scattering amplitude can be divided into two parts which, when extracted from optical model phase shifts, promise to offer an incisive tool for the analysis of angular distributions. The $\alpha + {}^{40}Ca$ reaction is used as an example of the usefulness of the scattering amplitude decomposition.

5840 (CONF-8403101—, pp 58-61) **Nucleon and energy exchange in low energy heavy-ion reactions.** Breuer, H.; Goekmen, A.; Kulesza, C.J.; Lavelle, G.; Mignerey, A.C.; Kwiatkowski, K.K.; Viola, V.E.; Birkelund, J.R.; Hoover, A.D.; Huizenga, J.R. (Univ. of Maryland, College Park). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A recent systematic study of the neutron (N) and proton (N) number distributions of projectile-like fragments observed in 8.3 MeV/u ^{56}Fe induced reactions on targets of ^{56}Fe, ^{165}Ho, ^{209}Bi, and ^{238}U has been extended to further projectile-target combinations and beam energies. Data for the $^{238}U+{}^{40}Ca$ reaction and 8.4 and 7.2 MeV/u have been taken at the LBL SuperHILAC and for the ^{209}Bi, $^{40}Ca+{}^{37}Cl$ reactions at 6.0 (Ca) and 7.3 MeV/u (Ca,Bi) at the ANL-LINAC. Total energy, energy loss and time-of-flight were determined with a solid state detector telescope (ΔE and E detectors separated by a flight path) with sufficient accuracy to allow the identification of each projectile-like fragment uniquely by mass and charge in all reactions. The experimental analysis of these data is based on two-dimensional Gaussian fits on N-Z distributions of projectile-like fragments as a function of energy loss (E/sub L/). For all reactions these fits gave an adequate representation of the experimental results, with the exception of the $^{238}U+{}^{40}Ca$ reactions.

5841 (CONF-8403101—, pp 76-79) **Quasielastic structure in the reaction $^{56}Fe + {}^{56}Fe$ at 14.6 MeV/nucleon.** Mignerey, A.C.; Merouane, C.; Bradley, S.; Benton, D.; Breuer, H.; Silk, J.D.; Kwiatkowski, K.; Viola, V.E. Jr.; Awes, T.C.; Obenshain, F.E. (Univ. of Maryland, College Park). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Indications that structure is enhanced for higher bombarding energies led to the study of the $^{56}Fe+{}^{56}Fe$ reaction at the Oak Ridge HHIRF using the 14.6 MeV/u ^{56}Fe beam. Emphasis was placed on obtaining unit mass and charge resolution for all projectile-like products. The total kinetic energy spectra of the cobalt products detected at 3°, 5° and 7° are shown. Several structures can be tentatively identified. The most striking feature is a strong peak corresponding to a total kinetic energy loss E/sub loss/=16-18 MeV (excitation energy E* of 12-14 MeV). While very prominent in the 5° and 7° spectra, this peak is not seen at 3° and may be interpreted as a proton transfer channel with an angular distribution characteristic of large angular momentum transfer. A second peak can clearly be identified at E/sub loss/ ~ 50 MeV for theta/sub lab/=5°; however, a similar structure appears at E/sub loss/ ~ 45 MeV for 7° and there are indications of something at E/sub loss/ ~ 55 MeV for the 3° data. Evaporation calculations show that this is the region of feeding from the first sequential neutron evaporation of ^{59}Co. Several other features are discernable at higher excitation energies which are difficult to understand in the framework of particle evaporation. While the results of the Z=27 energy spectra are encouraging, separation of the 5° data into spectra for individual cobalt isotopes does not greatly enhance the structure. The angular distributions of the four peaks defined by the 7° spectrum are plotted for 20 MeV bins in E/sub loss/. The lowest excitation energy bin, encompassing the E*=15 MeV structure, has an angular distribution which appears to be bell-shaped while the other excitation energy peaks become progressively more forward peaked with increasing excitation energy.

5842 (CONF-8403101—, pp 101-104) **Projectile fission in ^{58}Ni-induced reactions at 15.3 MeV/u.** Awes, T.C.; Ferguson, R.L.; Novotny, R.; Obenshain, F.E.; Plasil, F.; Rauch, V.; Sann, H.; Young, G.R. (Oak Ridge National Lab., TN). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract W-7405-ENG-26.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The present study was intended as a search for sequential fission of projectilelike fragments for reactions induced by intermediate-mass heavy ions. The objective was to determine the fission probability as a function of excitation energy or energy loss in the first step of the reaction. The experimental configuration was optimized for the detection of three-body sequential fission events over the full range of possible energy losses. The detector arrangement included a large-area ionization chamber which had two independent upper and lower halves, each capable of measuring the energy, E, and the energy loss, ΔE, of reaction products as well as their (x,y) position. A second detector was operated in coincidence on the other side of the beam axis. The inclusive charge distributions measured with the large-area ionization chamber for reactions of $^{58}Ni + {}^{58}Ni$ at 15.3 MeV/u were found to be dominated by products with $Z < 28$. Very little yield was observed for nuclei with charges greater than that of the projectile. It has been shown that most of the shift toward lighter products is consistent with the effects of equilibrium evaporation. At the largest calculated energy losses, the inclusive charge distributions were found to be slightly asymmetric due to an increasing component of fragments with half or less of the projectile charge. These light fragments were observed to have much broader angular distributions than the corresponding heavier fragments of the same energy loss. These observations from the inclusive measurements already suggest the occurrence of sequential fission of the projectilelike fragment. More conclusive evidence is obtained from the coincidence measurements.

5843 (CONF-8403101—, pp 105-108) **Three nuclei fragmentation in light-ion reactions at 11 MeV/u bombarding energy.** Buehler, M.; Gorks, A.; Pelte, D.; Weissmann, B.; Winkler, U. (Universitaet, Heidelberg, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The reactions $^{32}S+{}^{58}Ni$ and $^{35}Cl+{}^{58}Ni$ were studied at 355 MeV respectively 395 MeV beam energy. The experimental setup employed two large area ionization chambers for the coincident detection of two heavy fragments and a light particle detector system consisting of twenty independent scintillation counters. In the off-line analysis the nuclear charges Z/sub i/, the kinetic energies E/sub i/ and the linear momentum vectors p/sub i/ of the two detected nuclei were deduced. The deficits (marked by delta) of these parameters were obtained using the conservation laws. The deduction of nuclear charges, linear momenta etc. is correct for any number of particles. The distributions of the linear momenta are presented on the event-plane, which is defined by the coplanarity of the three momentum vectors p $Vector_1$, p $Vector_2$ and Δp Vector in the center of mass (cm) system. Additional information deduced from the scintillation counters are the multiplicity M of light particles and the ratio F/B of the number of particles detected in the forward and backward counters. In the reactions studied three fragment exit channels were clearly identified by means of the charge and momentum deficits deduced from two completely measured fragments and by the multiplicities of light particles. The reaction mechanism appears to be that of a direct fragmentation process and not of a normal deep inelastic process with subsequent fission of one of the two primary fragments.

5844 (CONF-8403101—, pp 186-190) **Collective flow effects observed with the Plastic Ball.** Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Lohner, H.; Ludewigt, B.; Poskanzer, A.M.; Renner, T.; Riedesel, H.; Ritter, H.G.; Warwick, A. (Gesellschaft fuer Schwerionenforschung, Darmstadt, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

At the Bevalac, collisions of Ca + Ca and Nb + Nb at 400 MeV/nucleon have been studied with the Plastic Ball/Plastic Wall detector. The Plastic Ball covers the angular region between 10° and 160°. It consists of 815 detectors where each module is a ΔE-E telescope capable of identifying the hydrogen and helium isotopes and positive pions. The ΔE measurement is performed with a 4-mm thick CaF crystal and the E counter is a 36-cm long plastic scintillator. Both signals are read out by a single photomultiplier tube. Due to the different decay times of the two scintillators, ΔE and E information can be separated by gating two different ADC-s at different times. The positive pions are additionally identified by measuring the delayed decay. The Platic Wall, placed 6 m downstream from the target, covers the angular range from 0° to 10° and measures time of flight, energy loss and position of the reaction products. In addition, the information from the inner counters (0° to 2°) is used to produce a trigger signal. Data show two different collection effects.

5845 **(CTA-IEAV-NT—07/84) Evaluation of neutron-induced reactions in ^{48}Ti and ^{238}U. Preliminary results.** Carlson, B.V.; Fiorentino, J.; Frederico, T.; Isidro Filho, M.P.; Mastroleo, R.C.; Rego, R.A. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). May 1984. 42p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700184.

Preliminary results of the evaluation of neutron-induced reactions in ^{48}Ti and ^{238}U are presented. Calculated cross sections for the reactions (n,γ), (n,n'), (n, 2n) and (n,p) as well as for (n,f) in ^{238}U are given. Comparisons with available experimental data are made and possible changes in the parameters are discussed.

5846 **(IAEA-RL—82) International intercomparison on the neutron flux density spectrum just before the REAL-80 project.** Ertek, C. (International Atomic Energy Agency, Seibersdorf (Austria). Laboratories). Jun 1981. 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703390.

This work briefly presents the results of the international intercomparison on the neutron flux density spectrum just before the REAL-80 intercomparison project. Some of the results of this intercomparison with a smaller number of laboratories will be also reflected in the REAL-80 project, therefore, it has some significant issues. This work is performed within the IAEA programme on standardization of reactor radiation measurements, one of the important objectives of which is the assistance of laboratories in Member States to implement or intercompare the multiple foil activation techniques for different neutron field measurements.

5847 **(INP—1200/PL) Fusion and nonfusion phenomena in the ^{6}Li+^{40}Ca reaction at 156 MeV.** Brzychczyk, J.; Freindl, L.; Grotowski, K. (Institute of Nuclear Physics, Krakow (Poland)). 1982. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703389.

Reaction products from ^{6}Li-induced reactions on ^{40}Ca at 156 MeV have been studied using the dE x E identification as well as the inclusive γ-ray method. The complete fusion cross-section has been found to be σsub(f)=(77 +- 11)mb. The Z distribution of fusion evaporation residues is compared with statistical model predictions. The Z spectrum of reaction products shows a maximum at 15<or approx. Z<=20, probably due to transfer and to incomplete fusion. It is suggested that the small value of the fusion cross-section results from the domination of the ^{6}Li break-up.

5848 **(TRI-PP—84-59) Search for muon electron conversion $\mu p + Ti \rightarrow e^- + Ti$.** Bryman, D.A.; Leitch, M.J.; Navon, I.; Numao, T.; Schlatter, P.; Dixit, M.S.; Hargrove, C.K.; Mes, H.; Burnham, R.A.; Hasinoff, M. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Victoria Univ., British Columbia (Canada); National Research Council of Canada, Ottawa, Ontario; British Columbia Univ., Vancouver (Canada); Montreal Univ., Quebec (Canada); Virginia Polytechnic Inst. and State Univ., Blacksburg (USA); Carleton Univ., Ottawa, Ontario (Canada); Los Alamos Scientific Lab., NM (USA); Chicago Univ., IL (USA)). Jul 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900290.

A progress report on a search for the lepton flavor violating reaction $\mu^- + Ti \rightarrow e^- + Ti$ is presented. No evidence for this process has yet been found leading to an upper limit $< 2 \times 10^{-11}$ (90% confidence level) relative to ordinary muon capture.

5849 **(UM-P—84/22) Spin rotation function in a microscopic non-relativistic optical model.** Bauhoff, W. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700086.

A microscopic optical potential, which is calculated non-relativistically with a density-dependent effective force, is used to calculate cross-section, polarization and spin-rotation function for elastic proton scattering from ^{40}Ca at 160 MeV and 497 MeV. At 160 MeV, the agreement to the data is comparable to phenomenological fits, and the spin-rotation can be used to distinguish between microscopic and Woods-Saxon potentials. A good fit to the spin-rotation function results at 497 MeV, whereas the polarization data are not well reproduced.

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 6516105829, 5835

5850 (CONF-8403101—, pp 149-152) **Droplet model of nuclear fragmentation at high energies: application to fragment nuclear charge distribution.** Porile, N.T.; Bujak, A.; Finn, J.E.; Gutay, L.J.; Hirsch, A.S.; Minich, R.W.; Scharenberg, R.P.; Stringfellow, B.C.; Turkot, F. (Purdue Univ., West Lafayette, IN). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

To describe fragment production in heavy ion reactions a classical droplet model has been generalized. The model has been used to fit experimental data from 30-350 GeV proton-heavy nucleus (Kr, Xe) reactions. The model is successful in explaining the mass yield distribution of particles, the isotopic yield distribution, the nuclear charge distribution and the kinetic energy spectra.

5851 (CONF-8403101—, pp 109-115) **First results of 35 MeV/u Kr + Au experiment at GANIL (Caen).** Adloff, J.C.; Boishu, B.; Dalili, D.; Genoux-Lubain, A.; Kamili, A.; Le Brun, C.; Lecolley, J.F.; Lefebvres, F.; Lhenoret, P.; Louvel, M. (CRN, Strasbourg, France). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Preliminary results of a study of the Kr + Au breakup reaction at 35 MeV/u performed at GANIL are presented. Atomic number versus velocity distributions are presented for reaction fragments under various conditions. The results are explained by a kinematic model involving fast binary reactions followed by sequential decays by fission.

5852 **(DOE/ER/40081—T1) Studies of nuclei far from stability in the A approximately equals 80 mass region. Final report, August 1, 1982-October 31, 1983.** Rester, A.C. Jr. (Florida Univ., Gainesville (USA). Space Astronomy Lab.). 26 Mar 1984. Contract AS05-82ER40081. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002982.

Progress is reported obtaining a clear picture of the structure of the very puzzling nucleus, ^{83}Sr. The angular distribution of the 522-keV gamma-ray transition in this nucleus has an anomalously large anisotropy. The analysis of our data suggests that the transition may have been incorrectly placed in the level schemes proposed by other groups. Our findings on ^{82}Sr have led us to undertake detailed studies of neighboring strontium, yttrium and zirconium nuclides as well. Workers at FSU have actively collaborated with us on these studies; other collaborative efforts include g-factor measurements with Vanderbilt and ORNL and electron scattering measurements with Vanderbilt and MIT.

5853 **(UM-P—84/29) Proton inelastic scattering in the interacting boson model: formalism and application to the Ge-isotopes.** Bauhoff, W.; Morrison, I. (Melbourne Univ., Parkville (Australia). School of Physics). 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700089.

The application of the interacting boson model to the coupled channel description of inelastic proton scattering is studied. The radial shape of the transition potentials is determined by analogy to the usual geometrical models, whereas the reduced matrix elements are calculated from the boson Hamiltonian. The general formalism is applied to scattering from the Ge-isotopes. A better description for the heavier isotopes is found in terms of an O(6)-symmetric model rather than a vibrational model.

6517 Nuclear Properties And Reactions, A=90-149

5854 (CONF-8403101—, pp 195-202) **Microscopic calculations of nuclear matter collective flow in Nb(400 MeV/N) + Nb.** Hoffer, J.B.; Kruse, H.; Molitoris, J.J.; Stoecker, H. (Michigan State Univ., East Lansing). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The recent experimental observation of sidewards peaks in the emission pattern of fragments emitted in collisions of heavy nuclear systems has stimulated a dispute among theorists about how to interpret these data. It has been shown that the observations are in agreement with the results of macroscopic nuclear fluid dynamical calculations, but several microscopic calculations done to simulate the sidewards emission (via the intranuclear cascade (INC) approach) failed - the angular distributions obtained where always forward peaked. A many body equations of motion (EOM) approach to study heavy ion collision has been developed. The approach is analogous to the early work of Bodmer et al., and Wilets et al. Hamilton's equations of motion are solved for an ensemble of nucleons with simultaneous mutual two-body interactions between all particles. The model predicts the sidewards emission peaks for the Nb + Nb reaction.

5855 (CONF-8403101—, pp 5-8) **Mass dependence of the fusion of Ni + Sn.** Lesko, K.T.; Henning, W.; Rosner, G.; Rehm, K.E.; Schiffer, J.P.; Stephans, G.S.F.; Zeidman, B.; Freeman, W.S. (Argonne National Lab., IL). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Preliminary results are presented for a comprehensive study of the fusion of Ni 64 and Ni 58 on Sn 112-124 for the energy range 150-200 MeV in the center of mass. Cross sections were measured for evaporation residues and for fission. Evaporation cross sections are a function of neutron excess while fission cross sections are not, a manifestation of compound-nucleus formation processes. Both evaporation residue and fission cross sections are enhanced at low energies.

5856 (CONF-8403101—, pp 84-87) **Polarization study of incomplete fusion dynamics.** Trautmann, W.; Bond, P.D.; Hansen, O.; Tricoire, H.; Hering, W.; Ritzka, R.; Trombik, W. (Brookhaven National Lab., Upton, NY). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC02-76CH00016.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Incomplete fusion reactions for ^{16}O on ^{144}Sm, ^{154}Sm and ^{93}Nb and ^{14}N on ^{93}Nb were studied using the Brookhaven tandem accelerator facility at energies from 95 to 140 MeV. Polarization of light charged particles from the reactions was studied by γ coincidence. Polarization is detected for α particles but is near zero for protons. α particle polarization shows energy dependence.

5857 **(DOE/ER/10494—5) Radioactive decay studies at TRISTAN. Progress report, January 1, 1983-September 30, 1984.** Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry). 1984. Contract AS05-79ER10494. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85003243.

Our study of nuclear structure of neutron-rich fission products at the on-line mass separator TRISTAN has continued at a strong pace during the past year. The study of the odd-odd La nuclides, $^{142\ 144\ 146\ 148}La$, has been concluded with the preparation of the ^{148}La level scheme. The systematic drop in position of the lowest 1^+ levels and the abrupt increase in the number of levels that are strongly fed in β decay in ^{146}La can be used to pinpoint the onset of strong deformation in that nuclide. Or, that spread of β strength can be attributed to the presence of low-lying octupole structures. New data have been presented on the lower odd-odd N=83 nuclides which indicate that the Pi g/sub 7/2/nu f/sub 7/2/ parabola which is a large particle hole parabola in ^{149}La is quenched in ^{138}Cs and inverted in ^{136}I. The first results of a major new study of ^{132}Sb and ^{130}Sb levels populated in the decay of 40-s ^{132}Sn and 2-min and 4-min ^{130}Sn, respectively, are reported. These data indicate a 4^+ ground state for ^{130}Sb and reveal many new negative parity levels. Angular correlation and decay scheme data are reported for decay of ^{139}Xe to levels of ^{139}Cs. The results support $5/2^+$ and $3/2^+$ assignments for the 218- and 289-keV levels, respectively, and reveal a close doublet at 393 keV. Except for an extra low-lying level, a nearly level-for-level correspondence is observed with isotonic ^{141}La, which is also under study. An angular correlation study of the levels of the 2-particle-4-hole nuclide ^{116}Cd fed in the decay of 2^- and 5^+ isomers of ^{116}Ag has resolved the location of the two lowest excited 0^+ levels and disclosed over 200 new γ rays. The possibility of intruder levels in ^{143}Ba is also under study.

5858 **(ITEF—184(1983)) Process of proton production in backward hemisphere.** Sibirtsev, A.A.; Stepanov, N.V.; Trebukhovskij, Yu.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703383.

The process of proton production in pA-interaction into the back hemisphere in the frames of the intranuclear cascade model is considered. Good agreement of the calculated energy and angular spectra with the experimental ones is revealed. Analysis of the mechanisms of multiple rescattering of the particle on nuclear nucleons and absorption of π-meson on a two-nucleon function is conducted. Kinematic boundaries of manifestation of the investigated mechanisms are determined.

5859 (JINR—D-3,4-82-704, pp 38-58) **Space parity breaking in the interaction of slow neutrons with nuclei.** Alfimenkov, V.P. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

Experiments on the problem of investigation of p-odd effects in the interaction of slow neutrons with ^{81}Br, ^{111}Cd, ^{117}Sn, ^{127}In, ^{139}La and ^{233}U nuclei are discussed in detail. Experiments were carried out in Grenoble, LINPh and JINR neutron physics laboratory. Effects of neutron-optical binary refraction and dicharoism are considered. Influence of these effects on values of total resonance cross sections close to p- and s-resonanses upon the dependence of total cross sections on neutron helicities and on energy dependence of neutron polarization rotation angle is evaluated. Experimental and calculation results are tabulated.

5860 **(JINR—R-4-83-463) Two-quasiparticle state strength distribution in Sn isotopes.** Voronov, V.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703374.

The strength distribution of the two-quasiparticle states, which could be excited in the two-neutron transfer reactions on Sn isotopes are calculated within the quasiparticle-phonon model (QPM). It is shown that the substructures observed via the (α, ^6He) reaction on ^{116}Sn can be observed in other Sn isotopes.

5861 (JINR-R—6-83-585) Experiments on the search for superdense Cs and Fr nuclei among the products of deuteron (4.3 GeV) and ^{3}He(11-15 GeV) interactions with Th. Avdeev, S.P.; Karnaukhov, V.A.; Kuznetsov, V.D.; Petrov, L.A.; Popov, V.V.; Yushkevich, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700091.

Submitted to the journal Sov. J. Nucl. Phys.

Experimental search for β-active superdense Cs and Fr nuclei among the products of ^{3}H (4.3 GeV) and ^{3}He (11-15 GeV) interaction with Th is described. The method of selective mass-spectroscopy with scanning β-activity distribution on the collector has been used. According to the Migdal theory of π-condensation it is expected that the region of β-stability of superdense nuclei is shifted towards Z=N. That is why appearance of relatively long-lived β-active isotopes in the region of essential neutron deficit has been chosen as a signal of anomaly. The following upper boundaries of cross section of anomalous isotope production in the units of total inelastic cross section of interaction (in the supposition Tsub(1/2)=5 h): for Cs in the range $112<=A<=119$-$5x10^{-9}$ for deutron beam and $2x10^{-7}$ in the range $100<=A<=122$ for ^{3}He beam, for Fr-$1.6x10^{-8}$ in the range $163<=A<=206$ (deutrons) and $2x10^{-6}$ for $172<=A<=210$ for ^{3}He beam are obtained. 29 refs.; 6 figs.

5862 Nuclear data sheets for A = 146. Peker, L.K. (National Nuclear Data Center, Brookhaven National Laboratory, Upton, New York 11973, USA). *Nuclear Data Sheets;* 41: No. 2, 195-323(Feb 1984). Contract AC02-76CH00016.

A summary of information obtained in various reaction and decay experiments is presented, together with adopted level schemes.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 6518105858

5863 (CONF-8403101—, pp 37-41) Macroscopic implications of diverse transfer mechanisms in heavy ion collisions. Dworzecka, M.; Goekmen, A.; Griffin, J.J. (George Mason Univ., Fairfax, VA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The results of calculations under three assumed forms of the transition probability for transfer reactions in the systems Fe + Ho and Fe + U are presented and compared. The results suggest that (N,Z) distributions may provide qualitative information on transfer mechanisms. None of the assumed mechanisms explains energy dependence satisfactorily.

5864 (CONF-8403101—, pp 80-83) Relaxation times for angular momentum in damped nuclear reactions. Doessing, T.; Randrup, J. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC03-76SF00098.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The evolution of the angular momentum distribution in damped nuclear reactions is discussed within the framework of the nucleon exchange transport model. First order equations are derived for the time evolution of the mean values and covariances of the spin variables. Solutions are given for 1400 MeV ^{165}Ho + ^{165}Ho reactions at various values of total angular momentum and total kinetic energy loss. Spin dispersions are well described by the calculations.

5865 (CONF-8403101—, pp 1-5) Recent results in heavy-ion-induced fission. Plasil, F.; Awes, T.C.; Cheynis, B.; Drain, D.; Ferguson, R.L.; Obenshain, F.E.; Sierk, A.J.; Steadman, S.G.; Young, G.R.; Gavron, A. (Oak Ridge National Lab., TN). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract W-7405-ENG-26.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A systematic investigation of angular-momentum-dependent fission barriers has been completed. Fission excitation functions were measured for the compound nuclei ^{153}Tb, ^{158}Er, ^{181}Re, ^{186}Os, and $^{204\ 206\ 208\ 210}$Po. In the case of ^{153}Tb and ^{181}Re, evaporation residue cross sections were also measured. With the exception of some of the Po systems, two to five different reactions were used to produce the same compound nucleus with projectiles ranging from ^{9}Be to ^{64}Ni. ^{12}C reactions with ^{174}Yb, ^{198}Pt, and ^{238}U at energies from 95 to 291 MeV; ^{16}O reactions with ^{143}Nd, ^{170}Er, ^{192}Os, and ^{238}U at energies from 140 to 315 Mev; ^{32}S reactions with ^{126}Te, ^{144}Nd, and ^{238}U at energies from 350 to 700 MeV; and ^{58}Ni reactions with ^{96}Zr, ^{116}Cd, and ^{238}U at 352 and 875 MeV have also been studied. Also, fission fragment angular distributions were measured for the above ^{12}C- and ^{16}O-induced reactions. The results were analyzed in terms of saddle-point moments of inertia obtained from the RFRM.

5866 (IFIN-FT—216-1982) Relative importance of relativistic induced interactions in the beta decay of ^{170}Tm. Bogdan, D.; Cristu, M.I.; Holan, S.; Faessler, A. (Institutul Central de Fizica, Bucharest (Romania)). Sep 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700180.

The log ft-values, the spectrum shape functions, and the beta-gamma angular correlation coefficients of the ^{170}Tm beta decay are computed in the framework of relativistic form factor formalism using asymmetric rotor model wavefunctions. Main vector and axial vector hadron currents being strongly hindered, the relative importance of induced interaction matrix elements is accurately estimated. Good agreement with experiment is obtained for the beta decay observables when the main induced interaction terms were taken into account. The contribution of the pseudoscalar term was found insignificant.

5867 (INP—1199/PL) Study of high angular momentum phenomena in rotating nuclei. Walus, W. (Institute of Nuclear Physics, Krakow (Poland)). 1982. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE84703377.

Information about rotational bands of deformed Yb nuclei as obtained through in-beam spectroscopic studies is discussed. Routhians and alignments have been extracted from the experimental data. Experimental single-quasineutron routhians have been used to construct two- and three-quasineutron routhians. Residual interaction between excited quasiparticles is obtained from a comparison of the excitation energies of multiple-quasiparticle states constructed from single-quasiparticle states. An odd-even neutron-number dependence of the alignment frequency of the first pair of isub(13/2) quasineutron in rare-earth nuclei is presented. This effect is explained by a reduction of the neutron pairing-correlation parameter for odd-N systems as compared to seniority-zero configurations in even-N nuclei. The signature dependence of the interband-intraband branching ratios as well as of the interband M1/E2 mixing ratios is discussed and compared to the signature dependence of B(M1) transition rates recently suggested by Hamamoto.

5868 (JINR—E-4-82-300) Situation with collective two-phonon states in deformed nuclei. Soloviev, V.G.; Shirikova, N.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703371.

Within the quasiparticle-phonon nuclear model with the operators of phonons depending on the sign of the angular momentum projection, the Pauli principle is taken into account in the two-phonon components of the wave functions. The centroid energies of the collective two-phonon states in even-even deformed nuclei are calculated. It is shown that the inclusion of the Pauli principle leads to their shift by 1-3 MeV towards high energies. The shifts of three-phonon poles due to the Pauli principle are calculated in the three-phonon components of the wave functions. The collective two-phonon states, the centroid energies of which are 3-5 MeV, are expected to be strongly fragmented. The conclusion is confirmed that the collective two-phonon states should not exist in deformed nuclei. The situation in ^{168}Er and in the ^{228}Th isotopes is analysed.

5869 **(JINR—R-7-83-809) Experimental determination of time components of the tungsten nucleus fission by ^{16}O ions.** Bugrov, V.N.; Karamyan, S.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1983. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703387.

Time delay of the nuclear fission acts induced by ^{16}O ions is determined by means of shadow effect with using a monocrystalline tungsten target. Minimum yield chi is measured depending on ion energy for shadow minima at 93 deg and 164 deg angles to the beam. Fixed values of the minimum yield difference Δsub(chi)=chi(93 deg)-chi(164 deg) provide the possibility to establish the significant contribution of the fission acts with approximately 10^{-17} s time delay. A smooth variation of the chi(164 deg) value at the 94.5 up to 131 MeV ion energy interval do not allow to conclude as to the observation of long lived fission component with $\tau > 10^{-16}$ s. Experimental results are compared with the statistical model calculations. The dependence of the shadow minimum parameters on ^{16}O ion dose density is followed in order to suppress uncertainties and clarify the methodical questions.

5870 (KEK—82-8, pp 77-79) **Non-radiative capture probabilities in ^{163}Ho.** Rajasekaran, G. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

5871 (KEK—82-8, pp 80-82) **Calculation of the intensities of x-ray emission accompanying orbital capture in ^{163}Ho.** Rajasekaran, G. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

5872 (KEK—82-8, pp 6-12) **Calculation of the spectrum of N-capture IBEC in ^{163} Ho.** Rajasekaran, G. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

The spectra of photons for the radiative electron capture in the 4Psub(1/2) and 4Psub(3/2) orbits of Ho-163 were calculated in the framework of the internal bremsstrahlung electron capture. The non-radiative capture rate was used for the normalization. Mann and Weber's results of the relativistic self-consistent Hartree-Fock calculation were used for the electronic wave functions. The resonance energy was taken from the X-ray data, and the width was taken from the calculation of Rahkonen and Krause. The Q-value was arbitrarily taken to be 2.100 keV. The total spectra for the capture in both 4Psub(1/2) and 4Psub(3/2) orbits were given for the neutrino mass of 0 and 50 eV in the graphs. The errors in the calculation of the nuclear matrix element may alter the absolute rate, but not the spectrum shape. The calculated values of the end-point energy are also given.

5873 (KEK—82-8, pp 13-18) **Radiative capture of orbital electron in $^{163}Ho \rightarrow {}^{163}Dy$ transition.** Hashimoto, Naoki (Tokyo Inst. of Tech. (Japan). Dept. of Physics). Sep 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

The spectra of photons in the orbital electron capture as well as in the non-radiative one were calculated for the transition from Ho-163 to Dy-163. A formulation for the emission probability of internal bremsstrahlung photons was given in terms of the reduced nuclear matrix element. The Coulomb's effect in the intermediate state was treated by means of the relativistic Coulomb's Green function. In the calculation, the wave function similar to that of relativistic hydrogen was used for the bound electrons in place of the result of relativistic Hartree-Fock. The Q-value for electron capture was assumed to be 2100 eV. The calculated photon spectra from the radiative electron capture in the 4Psub(1/2) and 4Psub(3/2) orbits were given for the neutrino mass of 0 and 30 eV. These spectrum shapes in the neighbourhood of the end-point are shown in the graphs, and it would give useful information on the neutrino mass if the accurate measurement of the photon spectra near the end point is made.

5874 **Determination of the cross section for $^{159}Tb(n,2n)^{158}Tb$ and the half-life of ^{158}Tb.** Prestwood, R.J.; Curtis, D.B.; Rokop, D.J.; Nethaway, D.R.; Smith, N.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] C: Nuclear Physics;* **30**: No. 3, 823-825(Sep 1984).

The half-life of ^{158}Tb was determined to be 180 yr using a combination of isotope dilution mass spectrometry and radioactivity counting techniques. The total uncertainty in this value is 6%. Using the newly measured half-life for ^{158}Tb, the cross section for the $^{159}Tb(n,2n)^{158}Tb$ reaction at 14.8 MeV was determined to be 1.93 b with an uncertainty of 7%.

6519 Nuclear Properties And Reactions, A=190-219

5875 (CONF-8403101—, pp 72-75) **Excitation energy sharing in quasielastic reactions between ^{86}Kr and ^{208}Pb.** Sohlbach, H.; Freiesleben, H.; Schneider, W.F.W.; Schuell, D.; Braun-Munzinger, P.; Kohlmeyer, B.; Marinescu, M.; Puehlhofer, F. (Ruhr-Universitaet, Bochum, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Quasielastic reactions between ^{86}Pb and ^{208}Pb have been studied at energies of 10, 13 and 18.2 MeV/u. The results of an analysis of the energy spectra of Kr like fragments are presented. Results show that inelastic excitations are enhanced with increasing energy and are affected by scattering angle. Monte Carlo simulations are compared with experimental results.

5876 (CONF-8403101—, pp 88-96) **What can we learn from spin depolarization measurements in damped nuclear reactions?.** Steckmeyer, J.C.; Lefebvres, F. (Universite de Caen, France). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The angular momentum transfer into fragments spins has been studied in the damped nuclear reactions Ar+Bi at 255 MeV and 295 MeV and Ni+Pb at 435 MeV from the measurement of the angular distribution of the fission fragments of the heavy recoil nucleus in coincidence with the projectile like fragment. These experiments have been done at Alice accelerator in ORSAY, the projectile like reaction products were detected and identified in charge by a ΔE.E silicon telescope, the coincident fission fragments and target like products in a position sensitive PPAC giving accurate time of flight measurements. The whole angular distribution (out of plane) and the in plane angular distribution (theta=90° +/- 10°) are reconstructed in Δphi and ΔTHETA bins from the sequential fission events and presented without and with Z/sub L/ (atomic number of the projectile like product) and TKEL (total kinetic energy loss) selections. For the lack of place, only the Ni+Pb angular distributions is presented. The strong inplane focusing of the fission fragment indicates at once that the spin of the heavy product is large and aligned along the normal to the reaction plane (the 90° to 0° ratio is almost of two orders of magnitude in the recoil direction. Another important observation is the clear increase of the width of the polar distributions as a function of the azimuth angle phi.

5877 (CONF-8403101—, pp 120-125) **Enhanced emission of non-compound light particles in the reaction plane.** Tsang, M.B. (Michigan State Univ., East Lansing). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

In an experiment performed at the K500 cyclotron at Michigan State University, light particles in coincidence with two fission fragments for ^{14}N induced reactions on ^{197}Au at 420 MeV incident energy have been measured. The fission fragments were detected with two large area position sensitive parallel plate avalanche detectors. Light particle telescopes consisting of silicon-ΔE and NaI-E detectors were placed both in and out of the plane defined by the centers of the two fission detectors and the beam axis. The momentum transferred to the composite system was determined by measuring the folding angle between the two outgoing fission fragments. Unlike observations with more fissile targets, however, transfer and inelastic reactions characterized by small linear momentum transfers contribute negligibly to the fission cross section for reactions on the ^{197}Au target. For events which lead to fission, the most probable linear momentum transfer corresponded to about 85% of the beam momentum. This is similar to the most probable momentum transfer observed for fusion-like reactions on ^{238}U at the same beam energy. Much of the missing momentum is carried away by non-equilibrium light particle emission.

5878 (CONF-8403101—, pp 145-148) **Entropy production in high energy nuclear collisions.** Westfall, G.D.; Jacak, B.V.; Gelbke, C.K.; Harwood, L.H.; Lynch, W.G.; Scott, D.K.; Stoecker, H.; Tsang, M.B.; Symons, T.J.M. (Michigan State Univ., East Lansing). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The idea that the entropy created in a nucleus-nucleus collision could be extracted from observed data was put forth the Siemens and Kapusta in 1979. Entropies in the range of 4-6 were extracted from the observed deuteron to proton ratios. The disagreement between these results and the expected entropy was interpreted as evidence for a soft equation of state. However more recent calculations indicate that heavier fragments must be included in the analysis in order to extract the entropy produced. Systematic measurements for complex nuclear fragments emitted at intermediate rapidities from reactions of ^{40}Ar with Au at 42, 92, and 137 MeV/nucleon are reported. The observed fragments with A = 1 - 14 are explained by emission from a common thermal source and the mass distributions are analyzed using a quantum statistical model to deduce the entropy created in the collision.

5879 **(FEI—1421) Solution of channel coupling problem on the basis of shell-model functions with R-matrix boundary conditions. Isobar analog resonances O^+ in ^{208}Bi nucleus.** Tertychnyj, G.Ya.; Yadrovskij, E.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703368.

Problems of convergence of the R-matrix method of channel coupling have been studied using as an example calculation of isobar analog resonance O^+ in ^{208}Bi nUcleus. Discrete hole-particle states in the Saxson-Woods potential were used as a shell basis. The channel radius was chosen at the asymptotic region boundary where one may neglect the nuclear potential. It has been shown that the calculation for the six basic states in each channel describes correctly the effects of channel coupling in partial cross sections of proton resonance scattering. Restuls are practically independent of the choice of the boundary condition parameter. The analysis of the integral contribution from remote poles of the R-matrix has been carried out. This contribution may be taken into account with a good accuracy in the diagonal approximation.

5880 **(GSI—84-35-Prepr.) Stopping power and collective flow of nuclear matter in the reaction Ar+Pb at 0.8 GeV/U.** Renfordt, R.E.; Schall, D.; Bangert, D.; Rauch, W.; Odyniec, G.; Pugh, H.G.; Schroeder, L.S.; Bock, R.; Brockmann, R.; Harris, J.W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jun 1984. 14p. NTIS (US Sales Only), PC A032/MF A01. File Number DE85750015.

Charged particle exclusive data for Ar + Pb collisions at 0.772 GeV/u are analysed in terms of collective variables for the event shapes in momentum space. Semi-central collisions lead to sidewards flow whereas near head-on collisions have spherical shapes in the c.m. frame, resulting from complete stopping of projectile motion. The hydrodynamical model predictions agree qualitatively with the data whereas the standard cascade model disagrees, lacking in stopping power and collective flow.

5881 **(JINR—R-4-83-741) Multinucleon transfer in the reactions of Heavy-ion deep inelastic collisions.** Dzholos, R.V.; Nasirov, A.K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703375.

The mechanism of the multinucleon transfer is investigated in the framework of the microscopic approach. The time-dependence of the width and shift maximum position of the charge distribution of nuclear reaction products is studied. The calculated results are compared with the experimental.

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 6520105845, 5845, 5863, 5868

5882 (CONF-8403101—, pp 67-71) **How is the excitation energy divided in partially damped collisions?.** Vandenbosch, R.; Lazzarini, A.; Leach, D.; Lock, D.K.; Ray, A.; Seamster, A. (Univ. of Washington, Seattle). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The system $^{56}Fe + ^{235}U$ has been studied with a beam energy of 480 MeV at the LBL SuperHILAC. The mass distribution of fission fragments was determined by their time of flight. Total excitation energy was determined from their kinetic energies. Relative yields of symmetric and asymmetry fission fragments were found to be sensitive functions of energy for energies below 60 MeV.

5883 (CONF-8403101—, pp 116-119) **Linear momentum transfer studies at energies around 100 MeV/u.** Cassagnou, Y.; Conjeaud, M.; Dayras, R.; Harar, S.; Kankeleit, E.; Klotz, G.; Legrain, R.; Nguyen, M.S.; Oeschler, H.; Pollacco, E.C. (CEN Saclay, France). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

In nucleus-nucleus collisions above the Fermi velocity a transition from nucleus-nucleus collisions to nucleon-nucleon interactions is expected. The study of this transition is the subject of the experimental program at Saturne II which up to now has been carried out using light projectiles and at GANIL with heavy projectiles. In order to characterize the reaction mechanisms, the linear momentum transferred from the projectile to the target is used. This quantity is accessible by the measurement of the angle and velocities of the fission fragments. By the use of heavy targets such as Th nearly all reactions terminate by fission and a general view of the occuring mechanisms can be obtained. Detailed information is obtained if lighter target nuclei are used whereby fission is less probable and only a selected range of impact parameters leads to fission or by precisely measuring all kinematic quantities in order to reconstruct the event. These various aspects mark the structure of this talk. In the first part, based on the measurements on Th, a classification of the reaction mechanisms is proposed, and in the second part data on lighter nuclei are discussed whereby high transferred momenta are selected and the precise measurements performed at GANIL are presented.

5884 (CONF-8403101—, pp 126-130) **Linear momentum transfer in intermediate-energy projectile-nucleus collisions.** Kwiatkowski, K.; Fatyga, M.; Karwowski, H.J.; Woo, L.W.; Viola, V.E. Jr.; Tsang, M.B.; Chitwood, C.B.; Fields, D.J.; Gelbke, C.K.; Lynch, W.G. (Indiana Univ., Bloomington). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Fairly complete systematics of linear momentum transfer distributions now exist for a variety of ions up to A = 20 and bombarding energies of E/A ~> 10 MeV. On a per nucleon basis the proton is the most effective agent of linear momentum transfer and heavy ions the least effective. For heavy ions (6 ≦ A ≦ 20) the average linear momentum transfer scales directly with projectile mass, producing a universal curve in terms of $<p_{11}>/A$. For all projectiles the average linear momentum transfer reaches a maximum at intermediate energies and then falls off gradually. For protons this maximum value is about 300 - 350 MeV/c, in contrast with the universal heavy ion value of $<p_{11}>/sup\ max/ \approx 145$ A MeV/c. Many of the qualitative features of the light-ion data can be understood in terms of fundamental N-N, d-N and α-N scattering processes. Intranuclear cascade calculations are consistent with the data although inadequacies in the mode are apparent. Finally, the need for an intensified theoretical effort to explain these data is clearly essential if these basic features of nucleus-nucleus collisions in the intermediate-energy regime are to be understood.

5885 **(DOE/ER/02025—5) Absolute measurements of neutron cross sections. Progress report.** (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). Nov 1984. Contract AC02-76ER02025. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003221.

In the photoneutron laboratory, we have completed a major refurbishing of experimental facilities and begun work on measurements of the capture cross section in thorium and U-238. In the 14 MeV neutron experimental bay, work continues on the measurement of 14 MeV neutron induced reactions of interest as standards or because of their technological importance. First results have been obtained over the past year, and we are extending these measurements along the lines outlined in our proposal of a year ago.

5886 **(DOE/ER/40137—1) Heavy ion interactions of deformed nuclei. Progress report, May 1, 1984-December 31, 1984.** Oberacker, V.E. (Vanderbilt Univ., Nashville, TN (USA)). Nov 1984. Contract AS05-84ER40137. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003029.

This progress report describes the main topics that were investigated during the reporting period: (a) a new microscopic approach to the calculation of heavy ion interaction potentials; (b) the dynamical orientation of deformed heavy nuclei near the distance of closest approach; and (c) the theory of Coulomb fission (project finished in Sept.).

5887 **(ITEF—183(1983)) Effective fragments from the uranium-233 and thorium-232 fission.** Galanin, A.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703382.

Parameters of effective fragments approximating neutron absorption by all ^{233}U thermal neutron fission products and ^{233}Th fission neutrons products excluding rapidly saturated (^{135}X, ^{105}Rh, sup(149, 151)Sm, ^{113}Cd, ^{157}Gd) are determined. approximation is performed at the accuracy of 1-2% for 10^{13}-10^{14} neutr./cm^{2}xs neutron fluence, hardness parameters of 0.1, 0.2, 0.3 at time of reactor operation equal to 6 years for 10^1,H3 flux and equal to 1 year for 10^{14} flux.

5888 (JINR—D-3,4-82-704, pp 245-259) **Problems of fission induced by neutrons.** Dlougy, Z. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

The review of studies realized by the present time on the investigation of the process of Np, Pu, U heavy nuclei isotope fission in (n, f) reactions is given. In the course of studying heavy nuclei fission with neutron reactions the most probable decay process is considered to be: radiation transition neutron emission, fission into two excited fragments. The problem of statistical transition through the fission barrier to the saddle point and the compound-states decay of nuclei based on the liquid drop model and Strutinsky shell. corrections is investigated. Introduction of corrections has lead to two-humped type of fission barrier. Intermediate structures in the neutron heavy nuclei fission cross section are considered. Two sets of auxiliary states corresponding to various forms of nuclei deformation (1 class-wave functions pertain to the 1st well, 2 class-to the 2nd one) are determined. Fission widths (FW) and FW distribution depending on state energy for 1 and 2 classes are calculated. The partial FW and 1 and 2 class state level width effect on the behaviour of nuclei finite states is studied. The problem of vibrational states damping and thorium anomaly in sOp(230,232)Th (n, f) reactions are discussed in detail.

5889 (JINR—D-3,4-82-704, pp 260-271) **Fission of oriented nuclei by neutrons.** Rabotnov, N.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

The available experimental data on fission of ^{235}U and ^{233}U oriented nuclei by resonance and fast neutrons are considered. Serious difficulties in combined interpretation of experimental results on fission of even-even compound nuclei formed in reactions at spinless targets and nuclei with a different from the zero spin are pointed out. As a possible physical cause of these divergences conservation of quantum number K (moment projection on symmetry axis) at various stages of the process is discussed.

5890 **(PB—84-221217) NBS (National Bureau of Standards) measurements of the (235)U fission cross section. Final report.** Carlson, A.D. (National Bureau of Standards, Washington, DC (USA)). Jul 1983. 17p. Pub. in Proceedings of International Atomic Energy Agency Consultants' Meeting U-235 Fast-Neutron Fission Cross-Section, Cf-252 Fission Neutron Spectrum held at Smolenice, Czechoslvakia on March 28-April 1, 1983, p61-77 July 1983.

Sponsored in part by International Atomic Energy Agency, Vienna (Austria).

The results of NBS measurements of the (235)U(n,f) cross section made at the linac, Van de Graaff, and (252)Cf facilities are reviewed.

5891 (UTNL-R—0122, pp 112-116) **Measurement of mass distribution of U-235 fission products in the intermediate neutron region.** Nakagomi, Yoshihiro; Kobayashi, Shohei; Yamamoto, Shuji; Kanno, Ikuo (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Wakabayashi, Hiroaki. Feb 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780068.

In Report of the Technical Research Committee in time of flight experiments, 1980 and 1981.

The mass distribution and the momentum distribution of U-235 fission products in the intermediate neutron region were measured by using a combination system of the Yayoi intermediate neutron column and an electron linear accelerator. The double energy measurement method was applied. A fission chamber, which consists of an enriched uranium target and two Si surface barrier detectors, was used for the measurement of the neutrons with energy above 1.3 eV. The linear accelerator was operated at the repetition rate of 100 Hz and the pulse width of 10 ns. The data obtained by the two-dimensional pulse height analysis were analyzed by the Schmitt's method. The preliminary results of the mass distribution and the momentum distribution of fission fragments were obtained.

6530 Nuclear Theory

5892 **(CASS-A—12-1984) Mathematical nature of anomalons.** Rosu, H. (Institutul Central de Fizica, Bucharest (Romania)). Jan 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700178.

Anomalons are the effect of the waiting (time) distance paradox operating near the origin of the Poisson process, which is the

propagation of relativistic heavy ions in nuclear emulsion. A formula for the mfp taking into account this paradox is obtained.

5893 (CONF-8403101—, pp 9-12) **Nuclear inertia for fission in a generalized cranking model.** Kunz, J.; Nix, J.R. (Los Alamos National Lab., NM). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A time dependent formalism which is appropriate for β vibrations and fission is developed for a generalized cranking model. The formalism leads to additional terms in the density matrix which affect the nuclear inertia. The case of a harmonic oscillator potential is used to demonstrate the contribution of the pairing gap term on the β vibrational inertia for Pu 240. The inertia remains finite and close to the limiting irrotational value.

5894 (CONF-8403101—, pp 42-45) **Damping of collective motion in extended TDHF.** Ayik, S. (Univ. of Maryland, College Park). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

In the present work, a formalism suitable to describe low velocity dissipative nuclear collective motion within the framework of the extended TDHF theory in the adiabatic limit is developed. As a first step in such a development, large amplitude slow collective motion described by a single collective variable q(t) and the conjugate variable p(t) is considered. The adiabatic approximation is introduced by assuming the collective velocity is small and, hence, by expanding the phase factor in powers of collective velocity to second order. In the same way expanding the mean field and the collision term in powers of collective velocity and equating the same order term separately, a set of coupled equations is obtained for the collective path rho$_0$ and circumflex Q. In order to make contact with the collective model, the total energy of the system is expressed in terms of the collective variables.

5895 (CONF-8403101—, pp 219-222) **High energy nuclear structures.** Boguta, J.; Kunz, J. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Nuclear field theory has been applied to study nuclear matter as well as finite nuclei. Within the mean field approximation the known bulk properties of nuclei such as binding energy, density, and compressibility are well reproduced. Charge and matter distributions of closed shell nuclei are in good agreement with experimental results, so are rms radii and single-particle energy levels. In addition to the description of known nuclear structure the field theoretical approach may reveal entirely new nuclear phenomena, based on the explicite treatment of mesonic degrees of freedom. The existence of such abnormal nuclear states was proposed by Lee and Wick employing the σ-model Lagrangian. There the non-linearity of the meson field equations allows for soliton solutions in the presence of nucleons, in particular the σ-field may exhibit a kink. Some of these solutions are considered.

5896 (CONF-8403101—, pp 156-160) **Transport properties of excited nuclear matter.** Danielewicz, P. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC03-76SF00098.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Despite the years of development of the hydrodynamic approach for the intermediate-energy heavy-ion collisions, one surprisingly finds that a major ingredient of the approach, the magnitude of the transport coefficient, has not been settled. The present study concerns a microscopic evaluation of the shear viscosity and heat conduction coefficients from the Uhlenbeck-Uehling equation, and an examination of the effect of the coefficients on the shock profile in the collisions.

5897 (CONF-8403101—, pp 203-206) **Baryon distribution in relativistic heavy-ion collisions.** Wong, C.Y. (Oak Ridge National Lab., TN). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract W-7405-ENG-26.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Recently there is considerable interest in highly relativistic heavy-ion collisions which was suggested as a way to produce a phase transition from the ordinary confined matter to the unconfined quark-gluon plasma. As the fraction of baryons in the early universe was small, it seems desirable to design a heavy-ion collider such that when the energy density in the central rapidity is high enough for a phase transition, there is no net baryon density there. Recent investigations reveal that the average downward shift of the projectile baryon rapidity is quite large. The formation of a pure quark-gluon plasma depends on the shape of the baryon momentum distributions. It is of interest to estimate the baryon momentum distribution. The baryon distribution is studied using the Glauber-type multiple collision model. Results indicate that in the energy range of $\sqrt{s}/A \sim$ 10-100 GeV, it is difficult to form a pure quark-gluon plasma in the mid-rapidity region without a baryon impurity of a few percent (in energy density). Increasing the collider energy brings some improvement to the degree of baryon impurity. However, by nature of the skew distributions due to multiple inelastic collisions, some baryon impurity remains.

5898 (CONF-8403101—, pp 207-210) **Initial energy density of quark-gluon plasma in relativistic heavy-ion collisions.** Wong, C.Y. (Oak Ridge National Lab., TN). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract W-7405-ENG-26.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Recently, there is considerable interest in the central rapidity region of highly relativistic heavy-ion collisions. Such an interest stems from the possibility of creating hadron matter of high energy density which may exceed the critical energy density for a phase transition between ordinary confined matter and the unconfined quark-gluon plasma. The estimate of the initial energy density is quite uncertain. The initial energy density is nonetheless an important physical quantity. It is one of the factors which determines whether the produced matter can undergo phase transition or not. As is well known, a simple Glauber-type multiple collision model can reproduce the total multiplicity and multiplicity plateau near the central rapidity region to within 30%. The simple multiple collision model has an approximate validity as a gross description of the reaction process. A semi-empirical approach is adopted here. Using the multiple collision model and the thickness function of Glauber, analytical functional forms for all the quantities in question are obtained. A single parameter, r/sub rms/, is adjusted to fit the experimental central rapidity multiplicity data. The semi-empirical results provide a useful tool to extrapolate to the unknown central rapidity region of heavy-ion collisions.

5899 (CONF-8403101—, pp 215-218) **Thermal properties of light nuclei with realistic effective Hamiltonians.** Bozzolo, G.; Vary, J.P. (Iowa State Univ., Ames). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC02-82ER40068.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A realistic microscopically derived nuclear equation of state for finite nuclei would be of great utility for interpreting current experiments in heavy ion scattering and high energy particle-nucleus experiments. A necessary and major step towards obtaining this equation of state involves solving for the thermal properties of nuclei without external constraints. A theoretical framework to explore the thermal properties of finite nuclei in the mean field approximation has been introduced by Bloch and di Domenicus. This framework and extensions to include the effects of superconductivity have been applied to nuclei with phenomenological Hamiltonians. In this paper a sample of an initial set of results for two representative nuclei, ^{16}O and ^{40}Ca in the finite temperature Hartree-Fock approximation (FTHF) is presented.

5900 (CONF-8403101—, pp 16-19) **Measurement of nuclear potentials from fusion excitation functions.** Huizenga, J.R.; Birkelund, J.R. (Univ. of Rochester, NY). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The basis for measuring nuclear potentials from fusion excitation functions at energies above barrier is reviewed. It is argued that because of experimental and conceptual problems fusion excitation functions at high energies cannot lead to model independent measurements of internuclear potential at small separations. The Al 27 + Ne 20 reaction previously analyzed by others is used as an example of problems arising from the inability to distinguish complete and incomplete fusion in experimental data.

5901 (CONF-8403101—, pp 46-49) **Dissipation and fluctuations in nucleus-nucleus collisions.** Feldmeier, H.; Spangenberger, H.; Beck, F. (Max-Planck-Institut fuer Kernphysik, Heidelberg, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A model of dissipation and fluctuations in low energy heavy ion reactions which is based on known macroscopic properties of nuclei, and contains otherwise no adjustable parameters, is presented. The general formulation can serve as a starting point for a more refined treatment of the coupling between macroscopic and microscopic variables. The calculated Wilczynski diagram for the reaction ^{136}Xe + ^{209}Bi at E/sub lab/ = 1422 MeV in comparison to experimental results is given. Only a qualitative comparison is possible since the present calculation does not allow for deformations in the exit channel, and consequently cannot lead to energy losses below the Coulomb barrier. The size of the fluctuations, however, is represented in a quite satisfactory way, even in the region of small energy losses.

5902 (CONF-8403101—, pp 50-57) **Exchange of particles, momentum and entropy.** Feldmeier, H. (Gesellschaft fuer Schwerionenforschung mbH, Darmstadt, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Within a unified microscopic model of heavy ion reactions transport coefficients for four different phenomena have been calculated. A gradient in chemical potential, $\Delta\mu$, drives the particle flux. The temperature mismatch, ΔT, drives the entropy flux. The velocity mismatch, Δu vector, sets in motion the momentum flux. In addition there is a coupling between particle and entropy flux in such a way that the hotter gas is giving away particle to the colder one. This effect, as has been pointed out by Moretto, counteracts the driving force towards symmetry in mass number. In how far it can be made responsible for the lack of mass drift seen in heavy ion collisions will be discussed later. Analytical expressions for all derivatives of Ω for the case of a classical single particle penetrability P (P=1 above, P=O below the barrier) have been worked out. Comparisons with experimental data are given.

5903 (CONF-8403101—, pp 62-66) **Exact quantal Schroedinger model of dinuclear flow: importance in kinetic pressure for flux rates.** Griffin, J.J.; Broniowski, W. (Univ. of Maryland, College Park). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A one-dimensional two-square-well independent particle model of the heavy ion dinucleus is analyzed by obtaining its exact time-dependent solutions numerically, and computing the time dependence of the number, N/sub R/(t), of nucleons on the right side, and of its dispersion, σ/sub R/(t). Then one inquires which features of the model system determine the time dependence of these quantities. The kinetic pressures of the interfacing Fermi gases emerges as a key determinant of the nucleonic fluxes. Consequently, finite translational velocities for the colliding nuclei also exert a strong influence on time derivatives of the quantities, N and σ^2.

5904 (CONF-8403101—, pp 136-139) **Simple estimates for Fermi jets.** Moehring, K.; Zielinska-Pfabe, M. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Window friction is one of the proposed mechanisms to understand a deep inelastic heavy ion reaction. Several authors investigated the implication that an early opening of the window allows the prompt emission of nucleons: due to the still high ion-ion relative velocity adding to the Fermi motion, some nucleons might get enough momentum not only to cross the window but actually to leave the system (Fermi jets, PEPS). A simple model is presented which allows for an aproximate estimate of the expected cross sections for a wide variety of heavy ion reactions.

5905 (CONF-8403101—, pp 140-144) **Formation of decay of a localized region of high excitation in heavy-ion reactions.** Lynch, W.G. (Michigan State Univ., East Lansing). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The spectra and multiplicities of light particles and complex fragments produced in intermediate energy heavy ion reactions are strongly influenced by the near equilivalence of the time scales for equilibriation and particle emission. In addition, there exist supporting evidence for the assumption of statistical emission mechanism, particularly for the description of complex fragment emission. Experimental data are review and comparisons made with calculations.

5906 (CONF-8403101—, pp 153-155) **Stopping power of heavy nuclei.** Csernai, L.P.; Kapusta, J.I. (Univ. of Minnesota, Minneapolis). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC02-79ER10364.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Inclusive cross sections for 100 GeV p+A $\rightarrow$ p+X are discussed in the framework of the evolution model proposed by Hwa. Improvements are made on Hwa's analyses and an exact solution to his model is obtained. A degradation length of 4.9fm rather than 17fm as inferred by Hwa is calculated.

5907 (CONF-8403101—, pp 161-164) **Robust observables in nuclear dynamics.** Remler, E.A. (Coll. of William and Mary, Williamsburg, VA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Nuclear dynamics describes in principle the time dependence of the density operator. Therefore, a well defined theory should contain some model of the density which can then lead to the unambiguous prediction of observables via basic scattering theory. Much theory being done in this field seems to needlessly ignore those exact results which are easily available from scattering theory and one purpose of this is to try to combat this state of affairs. TDHF, intranuclear cascade and fluid dynamics are prominent dynamical theories in use today and explicit models of the density operator can be associated with each of them. None of them however explicitly describes the development of correlations during the disassembly of nuclear matter into fragments. No current dynamical theories do this. Therefore, an observable which is sensitive to disassembly dynamics is a correspondingly uncertain indicator of the system's state prior to disassembly. Observables which are insensitive to poorly understood details of theories can be called robust. In heavy ion physics robust observables should therefore provide the most trustworthy tests of theories of nuclear matter prior to disassembly. This note will discuss a class of simple, robust observables and emphasize their close relation to observables introduced elsewhere.

5908 (CONF-8403101—, pp 165-168) **Mean field approach to pion production in intermediate energy heavy-ion collisions.** Tohyama, M.; Kaps, R.; Masak, D.; Mosel, U. (Universitaet Giessen, West Germany). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Pion production at incident energies below the NN threshold is one of the interesting phenomena in the field of intermediate-energy heavy ion physics. Since cooperative effects may play an essential role in heavy-ion subthreshold pion production, it is necessary to incorporate the dynamics of the collision into the theory. It is done here by using the time-dependent Hartree-Fock (TDHF) theory for the description of the dynamical evolution of the nucleus-nucleus collision. The Fermi motion, Pauli blocking, as well as dynamical distortion of the energy-momentum distributions are all inherent in this theory. In the present paper results of calculations in the slab geometry that contains essential features of head-on collisions and comparisons with experimental results are reported.

5909 (CONF-8403101—, pp 169-173) **Pion production in high energy heavy ion collisions.** Wolf, K.L.; Bock, R.; Brockmann, R.; Dacal, A.; Harris, J.W.; Maier, M.; Ortiz, M.E.; Pugh, H.G.; Renfordt, R.E.; Sandoval, A. (Texas A and M Univ., College Station). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC03-76SF00098.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Experimental data for heavy ion pion production reactions are compared with the predictions of a number of versions of cascade models. Pion suppression effects observed in the experimental data are fit by introducing refinements into cascade theory. Impact parameter adjustment, off-shell effects on the potential and perturbations due to nuclear matter are considered.

5910 (CONF-8403101—, pp 174-177) **New evidence for hot spots from subthreshold pions.** Aichelin, J. (Michigan State Univ., East Lansing). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Recently pion production cross section was measured in heavy ion collisions at low and moderate bombarding energies. The measurements show the systematic behavior of the excitation function, the energy and angular distribution, and the target mass dependence of the cross section. A statistical hypothesis is made about the reaction mechanism. The compound nucleus model describes the data on symmetric systems remarkably well. The extension to asymmetric systems is reported here.

5911 (CONF-8403101—, pp 178-181) **Anisotropy ratio for particle-inclusive production in high energy nucleus-nucleus collisions: a sensitive probe for pion production mechanisms.** Malfliet, R.; Schuermann, B. (Kernfysisch Versneller Instituut, Groningen, Netherlands). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

A near-analytic multiple collision (transport) model which describes nucleon and meson as well as light fragment emission in the energy range of 400 to 2100 MeV per nucleon is developed. The approach is based on the relativistic Boltzmann equation for nucleon production. Through an expansion of the one-particle distribution function in terms of the number n of independent nucleon-nucleon (NN) collisions the Boltzmann equation can be recast in an infinite set of coupled integro-differential equations. Linearizing these equations by letting the test nucleon scatter with a partner nucleon whose distribution is stationary (a Fermi distribution for the first collision n=1, a thermal distribution for $n \geq 2$) they can be solved in the eikonal approximation. Comparisons are made with experimental data for the reaction Ar + KCl.

5912 (CONF-8403101—, pp 211-214) **Statistically generated events and the fluid-dynamical expectation in high energy nucleon collisions.** Csernai, L.P.; Randrup, J.; Fai, G. (Univ. of California, Berkeley). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

Experimental developments point in the direction of measuring exclusive quantities in high-energy nuclear collisions. On the theory side a computer simulation model has been put forward recently to generate complete (exclusive) events statistically. In the present work this model together with fluid-dynamical results is used to see how the formation of composite fragments, the finiteness of the multiplicity, and the statistical fluctuations in the final states affect the event analysis. From a series of detailed three-dimensional fluid-dynamical calculations certain gross features are extracted that are used to give an approximate characterization of the final state of the fluid dynamical state of the collision in terms of a few subsystems (sources), a participant source and up to two spectator sources.

5913 (CONF-8403101—, pp 32-36) **Particles + core reduction of the fission equations in the time dependent mean field approximation.** Boneh, Y.; Levit, S. (Nuclear Research Centre Negev, Beersheba, Israel). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The fission equations in the time dependent mean field approximation are very difficult to solve. A particle + core reduction of the ordinary TDHF is applied to the equations. The resulting equations are still a boundary value problem but, by proper choice of a basis and a number of free parameters, they can be made numerically tractable.

5914 (CONF-8403101—, pp 28-31) **Nuclear mass formula with a neutron skin degree of freedom and finite-range model for the surface energy.** Moeller, P.; Myers, W.D. (Lawrence Berkeley Lab., CA). Apr 1984. NTIS, PC A11/MF A01. File Number TI84013540. Contract AC03-76SF00098.

From 3. winter workshop on nuclear dynamics; Copper Mountain, CO, USA (5 Mar 1984).

The possibility of extending the model used by Moeller and Nix in 1980 to calculate nuclear masses and fission barriers for nuclei throughout the periodic system to include provision for the existence of a neutron skin is studied. The model gives excellent fit to masses and fission barriers and improves predictions of isotopic trends in charge radii.

5915 **(DOE/ER/40143—1) Theoretical studies in few-body intermediate energy physics.** Mizutani, T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Physics). 1984. Contract FG05-84ER40143. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003241.

Progress is reported on the following studies: coupled πNN-NN systems and low energy anti p-p interactions. A paper is included on meson exchange models for low energy nucleon-antinucleon scattering. (WHK)

5916 **(IC—83/197) Properties of nuclear matter with an excess of neutrons, of spin-up neutrons and of spin-up protons using the Skyrme interaction.** Hassan, M.Y.M.; Ramadan, S. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700076.

The binding energy of nuclear matter with an excess of neutrons, of spin-up neutrons, and of spin-up protons (characterized by the corresponding parameters, αsub(tau)=(N-Z/A), αsub(n)=(Nup-Ndown)/A, and αsub(rho)=(Zup-Zdown)/A), contains three symmetry energies: the isospin symmetry energy Esub(tau), the spin symmetry energy Esub(σ), and spin-isospin symmetry energy Esub(σtau). General expressions for Esub(σ), Esub(tau) and Esub(σtau) are given in the case of the Skyrme interaction. These values are compared with previous results ob-

tained by Dabrowski and Haensel (DH) with Brueckner-Gammel-Thaler, the Hamada-Johnston, and the Reid soft core nucleon-nucleon potentials. The spin, isospin and spin-isospin dependent parts of the single-particle potential in nuclear matter are also calculated using the Skyrme interaction. The spin, isospin and spin-isospin incompressibility are calculated using the Skyrme interaction. The spin-spin part of the optical model potential is estimated. The results are compared with those of Dabrowski and Haensel (DH) and Hassan and Ramadan.

5917 **(IC—83/198) Spin saturation and thermal properties of nuclear matter.** Hassan, M.Y.M.; Ramadan, S. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700077.

The binding energy and the incompressibility of nuclear matter with degree of spin saturation D is calculated using the Skyrme interaction and two forms of a velocity dependent effective potential. The effect of the degree of spin saturation D on the thermal properties of nuclear matter is also discussed. It is found that generally the pressure decreases with increasing D.

5918 **(IFIN-FT—204-1981) Experimental evidence for dual diffractive resonances in nucleon-nucleus scattering.** Ion, D.B.; Ion-Mihai, R. (Institutul Central de Fizica, Bucharest (Romania)). Sep 1981. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700161.

Experimental data on nucleon-nucleus scattering for laboratory momenta between 0.9:10 GeV/c are analysed in terms of the dual diffractive resonance (DDR) mechanism. The experimental data for all the nuclei are found to agree well with the predictions of the collective DDR states dominance.

5919 **(IFIN-FT—220-1982) Existence of coherent rotational states in nuclei.** Brandus, I.; Carstoiu, F.; Dumitrescu, O. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700181.

The contribution of the β-vibrational band coupling in the structure of the coherent rotational states (CRS) formed in the heavy ion collision is analysed. It is shown that the coherence does not disappear when including virtual excitations to the members of the β-band if the energy of the projectile is not too high (approximately 75% of the barrier's height) and if the absorptive part is a few percent of the real part of the interionic potential.

5920 **(IFIN-FT—236-1984) Semiclassical treatment of the interaction between individual and quadrupole collective degrees of freedom.** Raduta, A.A.; Ceausescu, V.; Gheorghe, A.; Popa, M.S. (Institutul Central de Fizica, Bucharest (Romania)). Feb 1984. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700177.

Two types of interactions between a system of paired spherical shell model nucleons and a phenomenological quadrupole vibrational core are semiclassically treated. One induces a specific dependence of the gap parameter on the core's angular momentum while the other one renormalizes the single particle energies by a β^2-term. The former case enables one the interpretations for a sequence of states of the same angular momentum J - horizontal band -as RPA - multiphonon states describing vibrations of small amplitudes around the ground state J^+. A vertical band J, J+2, ... is built by an approximative projection of angular momentum from a variational trial function. Application to ^{188}Pt shows a good agreement with experiment. The second type of interaction renormalizes the energy of the quadrupole mode and shifts the zero point energy. Using the phase space coordinates one defines three distinct boson representation for the quasi-spin operators, which are useful for improving the RPA approach. One concludes that the particle-core interaction affects essentially not only the states lying beyond the crossing point of yrast collective and 2qp bands but also the low lying collective states.

5921 **(INS—460) Annihilation interaction, mean collision number and average multiplicity in antiproton-nucleus collisions.** Sumiyoshi, H.; Kondo, H.; Uehara, M. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Dec 1982. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703236.

Within the multiple scattering model it is discussed how to treat the annihilation interaction in antiproton-nucleus (p-bar-A) collisions by imposing the constraint that real annihilation of the incident p-bar can take place only once. The cross sections, mean collision numbers and average multiplicities are given both for the p-bar-A annihilation and non-annihilation events. The multiplicity difference between p-bar-A and p-A collisions is shown to be useful as a test of the annihilation mechanism.

5922 **(INS—464) Nucleus as a canonical ensemble.** Sato, Hiroshi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Feb 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703235.

Highly excited nuclear states formed by high energy nuclear collisions are studied in terms of the antisymmetrized temperature dependent density matrices for many fermions interacting with a harmonic oscillator force. Firstly the relationship with the conventional shell model is discussed. And then spectra of particle emissions, heat capacities and entropies are calculated with density matrices derived. It is found that quantities calculated are consistent with those found experimentally in nuclear collisions. The coalescence model is formulated with these density matrices.

5923 (INS-NUMA—36, pp 32-37) **πNN resonance.** Ueda, Tamotsu (Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Faddeev πNN calculation suggested that the $^3F_3$ state in pp channel was able to be understood as a πNN resonance. The difference between the phase behavior found by Kloet and Silbar and by Araki, Koike and Ueda was attributed to the off-shell structures of potentials used for the calculation. A reasonable potential for the πN-p_{33} system leads to a unified interpretation of the anomalous phase structure of $^3F_3$ state in pp-pp, pp-πd and πd-πd processes. The contribution from heavy mesons to the resonance part of phase shift and the dip in the absorption coefficient can be incorporated by replacing the π exchange in the relevant diagrams with π exchange and rho exchange. The form factor was assumed in the form of $Cp/(p^2 + \beta^2)$, and the parameter C and the mixing of spin 1/2 and 3/2 of rho-N system were determined by referring to the one-π exchange and one-p exchange potential in NN-NN and NN-NΔ processes. The value of β was parametrized as $\beta^2 = n\Lambda^2$. By choosing Λ = 1.2 GeV, n is determined to be three. The computational results of the amplitudes of $^1D_2$ and $^3F_3$ channels in pp-pp, pp-πd and πd-πd processes are summarized, and the contribution of rho is important in pp-$^3F_3$ and pp-$^1D_2$ phase parameters.

5924 (INS-NUMA—36, pp 38-42) **Quark shell model and short-range nuclear force.** Oka, Makoto (Kobe Univ. (Japan)). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

The calculation of short-range nuclear force with a quark shell model was performed, and compared with that performed by Harvey et al. All the states of three-quark systems and six-quark systems with energy less than a certain value in harmonic oscillator shell model were taken into account. The three-quark states consisted of two types, and the latter corresponds to the breathing mode excited state. Among eight six-quark states, four states were able to be rearranged into cluster states. The argument by Harvey et al. was that the hidden color state mixed with one of the cluster state and lowered the energy. By imposing on the potential of quark systems the variational condition which ensures the decoupling of two states, it was shown that the hidden color state did not mix with

cluster states, and only the latter state was sufficient to obtain the energy of the ground state. The calculation by Harvey et al. did not take into account the variational condition, and it was concluded that their calculation was an inconsistent one.

5925 (INS-NUMA—36, pp 43-47) **OBEP-approach to π^0-condensation and the [ALS]-model including isobar Δ(1232) in the iso-symmetric nuclear matter.** Kunihiro, T. (Kyoto Univ. (Japan). Dept. of Physics). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

The π^0-Condensation in the iso - symmetric nuclear matter is studied from the viewpoint of OBE (One-Boson-Exchange) model. The [ALS]-model including the isobar Δ(1232) is employed as a model of the baryon system. The short range correlation between the baryons are taken into account by introducing a correlation function. Preliminary calculation shows the following: The net contribution from the rho-mesons is repulsive as in the neutron matter although the one from the charged rho-mesons are attractive. Increase in the kinetic energy due to localization of the system together with the potential energy due to the rho-meson exchange causes positive pressure of the system.

5926 (INS-NUMA—36, pp 48-53) **Alternating-layer-spin structure based on the quark picture.** Tamagaki, Ryozo (Kyoto Univ. (Japan). Faculty of Science); Tatsumi, Toshitaka. May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Description of the ALS (Alternating-Layer-Spin) structure based on the quark picture is studied by the use of the chiral bag model. As a version of "percolated phases" resulting from such an ordered phase as the π^0 condensation at high density, a possible ALS-like structure of quark matter is preliminarily reported.

5927 (INS-NUMA—36, pp 54-59) **Nucleon superfluidity under coexistence of neutral and charged pion condensations.** Takatsuka, T. (Iwate Univ., Morioka (Japan)); Tamagaki, R. May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Nucleon superfluidity under the simultaneous condensation of neutral pion (π^0) and charged one (πsup(c)) is investigated in a simple model calculation. It is noted that the pairing correlation is characterized both by the two-dimensional nature due to π^0-condensation and the appearance of attenuation effect caused by the πsup(c)-one. Even under the situation, nucleons in neutron star interior are expected to be superfluid with the critical temperature 10^{8-9} °K.

5928 (INS-NUMA—36, pp 6-9) **Effect of Δ holes on magnetism and Gamow-Teller transition.** Shimizu, Kiyotaka (Tokyo Univ. (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Recently, the influence of Δ-resonance on magnetic moment and Ml and GT type transition has been variously discussed, and the proof of the existence of Ml and GT type giant resonance and the measurement of the transition intensity have been carried out actively. As the method, the effective operator for Ml and GT type transition in nuclei is calculated by the theory of perturbation according to the conventional methods of coordination mixing and exchange current. As the effective interaction especially among others, the method of taking the very simplified form of Landau-Migdal type and adopting up to high order terms in RPA has been performed. In this paper, in order to study to what extent such method is justified, the meaning of the effective interaction written in the Landau-Migdal type is explained by the simplified model, and comparison is attempted with the treatment by perturbation theory exactly considering the realistic effective interaction and the antisymmetry among nucleons. In the nucleon-hole interaction, the parameter showing the intensity of a repulsive force was about 0.7, and it is the established theory that the preceding phenomenon is not likely to be observed. The effect of the state of Δ holes was examined on real nuclei, the nuclei A = 41 with Ca-40 core and Ca-48.

5929 (INS-NUMA—36, pp 10-14) **Effect of virtual pions in (γ, p) inclusive reaction.** Wakamatsu, Masashi; Matsumoto, Kimio (Osaka Univ., Toyonaka (Japan). Faculty of Science). May 1982. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number TI85780069. (CONF-8112110—).

From Meeting on nuclear physics of intermediate energy; Tanashi, Tokyo, Japan (14 Dec 1981).

Now, the photon beam of good quality has become available, and the interest to photo-nuclear reaction heightens rapidly. The remarkable trend of recent experiment is to turn a look also to inclusive measurement in addition to exclusive measurement so far. It was found by coincidence experiment that the protons contributing to the second peak region in the spectrum of a γ + nucleus → p + anything reaction were not accompanied by charged particles. It suggests that (γ, pp) reaction cross section is very small as compared with that of (γ, pn). However, theoretically the question "Why quasi-deuteron picture is good?" arises immediately. The authors decided to consider the mechanism of photon absorption by somewhat microscopic calculation. The outline of the calculation made by the authors is reported. Only the treatment of two-body process contributing to the second peak is described. As the model of nuclei, the simplest Fermi gas model was used. The proton spectrum in γ + C-12 → p + anything reaction is shown. The proportion of pp emission and pn emission in the two-nucleon emission process contributing to the proton spectrum is most interesting. The pp emission was remarkably suppressed, therefore, photons were mainly absorbed by pn pairs.

5930 (INS-NUMA—37, pp 92-97) **Production of hypernuclei by high energy heavy-ion collision.** Muraoka, Mitsuo (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study); Bando, Koji. Jun 1982. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number TI85780070. (CONF-8201101—Exc.).

From Workshop on structure of hypernuclei; Tanashi, Tokyo, Japan (18 Jan 1982).

The cross section for the production of hypernuclei by the capture of the Λ particles produced by the high energy heavy ion collision was estimated. First of all, the probability of the production of a Λ particle by the collision was obtained. The probability includes a probability of multiple nucleon-nucleon collision. The average number of the production of Λ particles is 0.015. The inclusive cross section of K^+ and Λ particle production was obtained. The experimental values of the inclusive cross section of K^+ particle production in Ne + Ne collision experiment at the energy of 2.1 GeV/A were compared with the theoretically estimated values. The theoretical values were a little smaller than the experimental values. The cross section of Λ particle production obtained theoretically is also presented. The production cross section of spallation fragments was obtained. In this paper, the spallation of incident nuclei or target nuclei due to the peripheral collision was considered. The exponential dependence of the production probability on the reaction Q value was seen. The production cross section of hypernuclei was also calculated.

5931 (INS-PH—2, pp 89-98) **Short-range correlation of nucleons in the nucleus through photo- and electron-production of particles from nuclei.** Homma, Saburo (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Apr 1982. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number TI85780071. (CONF-8201102—).

From Meeting on physics of two nucleon systems; Tanashi, Tokyo, Japan (19 Jan 1982).

The short-range correlation of nucleons was studied. The nuclei as seen with high energy electrons and gamma ray are considered to be composed of points, and the interactions can be treated as impulse. In this case, the knock-out process of a nucleon is

possible. The momentum distribution of nucleons in a nucleus is measured through this process. The data on O-16 showed that the simple shell model reprodeced well the experimental data for the region with momentum less than 400 MeV/c. In higher momentum region, difference was seen between the experimental data and the calculated values. For this region, the finite size of nucleons must be considered. The knock-out of neutrons is also important. The experimental results of neutron knock-out process are scarce, and are not reliable. Two nucleon emission by a photon is a probe to study the short-range correlation. The experiments made at INS, University of Tokyo, were analyzed by a phenomenological approach. An analysis considering the exchange diagram and the effect of delta is in progress. The form factor of proton-neutron system can be deduced through the (e, e'd) reaction. The form factor of proton-neutron system in a nucleus is considered to be the same as that of a deuteron. Construction of high energy, high duty and high intensity electron accelerators is expected for further study.

5932 **(ITEP—56(1983)) Nucleon-nucleon scattering in the compound bag model: a p-matrix analysis of the $^3S_1$-$^3D_1$ channels at Tsub(L) <= 1 GeV.** Grach, I.L.; Narodetskij, I.M.; Veselov, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703369.

The data of a recent phase-shift analysis VPI-SU are used to calculate the P-matrix for the coupled $^3S_1$-$^3D_1$ proton-neutron channels for the laboratory energy Tsub(L) approximately equal to 1 GeV. The two-channel P-matrix calculated for the radius of the equivalent hadronic bag b=6.7 GeV^{-1} is shown to have one pole at $\sqrt{s}$ = 2.16-2.17 GeV in agreement with the MIT bag model prediction. It is shown that for Tsub(L) <= 150 MeV the P-matrix elements, are very sensitive to the errors of the phase-shift solutions, expecially for the mixing parameter anti epsilon$_1$. It is shown also that the P-matrix calculated from both the energy-dependent and single-energy (with the statistical errors neglected) VPI-SU solutions strongly disagrees to that for several realistic potential models in the energy region Tsub(L) <= 150 MeV. This contradiction can be removed if the values of anti epsilon$_1$ would be changed by one or two standard deviations.

5933 (JINR—D-3,4-82-704, pp 66-86) **Study on the neutron resonances of atomic nuclei with steady nuclear reactors.** Vertebnyj, V.P. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

Two problems pertaining to the study of neutron resonance properties are considered in the lecture investigation on slow neutron interaction with radioactive isotopes, investigation on heavy and medium nuclei-neutron interaction in the region of unresolved resonance with filtrated beams of intermediate neutrons. These investigations have been developed at the series of steady nuclear reactors and are substantial addition to the investigations in the region of resonance neutron spectroscopy at pulse sources.

5934 (JINR—D-3,4-82-704, pp 87-104) **Quasiparticle-phonon model and the description of radiative strength functions.** Stoyanov, Ch. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

On the basis of experimental data on the framework of quasiparticle-phonon model of nucleus (QPM) the values of radiation strength functions (RSF) of electromagnetic transitions for spherical nuclei with mass numbers 35<A<240 are assessed. Analysis of possible reasons for the change of RSF depending on nucleus mass number and neutron bond energy is given. Description of the widths E1-and M1 resonances in QPM and their effect on RSF is discussed. The analysis of the experimental data according to gigantic resonance fragmentation in intermediate and heavy nuclei shows that QPM reproduces the data well. Calculations of RSF taking into account interactions of mono- and biphonon configurations in odd nuclei are given, RSF in spherical nuclei are calculated. It is established that QPM describes satisfactorily the change of strength M1- and E1-transitions depending on mass number and near neutron (Bn) bond energy. The calculations show that RSF fluctuate depending on the energy in the range (Bn, Bn+2MeV).

5935 (JINR—D-3,4-82-704, pp 117-144) **Neutron and radiative widths and effects of compound state parity mono-conservation.** Kadmenskij, S.G.; Furman, V.I. 1982. (In Russian). NTIS (US Sales Only), PC A23/MF A01. File Number TI84780542. (CONF-820658—).

From 4. international school on neutron physics; Dubna, USSR (8 Jun 1982).

To study the structure of resonance states of spherical and deformed nuclei a review of works on the study of neutron resonances (NR) in intermediate and heavy nuclei is presented. Analysis of characteristic properties of NR is made. The structure of compound-states of different parity is considered. On the basis of the known experimental data for NR of deformed nuclei the problem of non-conservation of spin projection on nucleus symmetry axis in the presence of coriolis mixing has been studied. Analysis of experimental and theoretical data on the structure of giant M2-resonances is given. Mixing coefficient of different parity states in compound-nucleus, neutron widths and strength functions for spherical and deformed nuclei are evaluated. It is established that mechanisms of dynamic increase of the effects of parity non-conservation are connected with virtual excitation of weak interaction of giant O^--resonances, it permits to explain the order of values of experimentally observed p-odd asymmetry coefficients.

5936 **(JINR—E-2-83-775) Simple method for calculation of Glauber's amplitude.** Omboo, Z. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703370.

A method of calculating the terms of Glauber series expansions for elastic scattering of composed systems are presented. The inclusion of general scattering diagram simplifies essentially the calculation procedure. In this case the complicated combinatorical problem of reduction of similar terms in Glauber series is solved easily and the determinant corresponding to various terms of the series decreases at least by a factor of two, if numbers of constituents of scattered systems are equal. If these numbers are not equal, the determinant order is equal to the smallest one.

5937 (KEK—82-8, pp 83-86) **Factorization of the resonance-peak in IBEC.** Rajasekaran, G. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Sep 1982. NTIS (US Sales Only), PC A05/MF A01. File Number TI85780011. (CONF-8203187—).

From 4. workshop on the mass of the electron neutrino; Oho, Ibaraki, Japan (27 Mar 1982).

5938 **(KFKI—1984-28) Exactly soluble model for light particle emission and transfer in heavy ion reactions.** Revai, J. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700083.

The authors consider the quantum mechanical problems of a particle in the field of two potentials moving on classical trajectories. An exact Faddeev-like formulation is given for simultaneous treatment of elastic, transfer and break-up channels with definition of corresponding physical amplitudes. The use of separable potentials leads to equations that allow exact numerical solution. 4 refs.

5939 **(KFKI—1984-35) Dynamical aspects of the transition from nuclear matter to quark-gluon plasma in heavy ion collisions.** Barz, H.W.; Kaempfer, B.; Csernai, L.P.; Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700078.

Taking into account a finite conversion rate, the transition of nuclear matter to quark-gluon matter and vice versa is treated in a hydrodynamical model for heavy ion collisions. For fast conver-

sion, pure quark matter is formed for laboratory energies between 4 and 10 GeV per nucleon while below 4 GeV per nucleon matter stays in a mixed phase. Due to the large amount of latent heat, the temperature does not exceed kT=160 MeV. 11 refs.

5940 **(KFKI—1984-53) Extra entropy production due to non-equilibrium phase transitions in relativistic heavy ion reactions.** Csernai, L.P.; Barz, H.W.; Kaempfer, B.; Lukacs, B. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700084.

In a fluid-dynamical model the extra entropy production is calculated which arises from a non-equilibrium phase transition from nuclear to quark matter. The dynamics of processes producing extra entropy are treated in linear approximation. It is shown that there is a considerable extra entropy production provided the transition is not too fast. In measuring the entropy at the break-up, an excess entropy might signalize the phase transition to a transient quark-gluon plasma. 9 refs.

5941 **(RAL—84-028) Change of confinement scale in nuclei: predictions for structure functions confront electroproduction data.** Close, F.E.; Roberts, R.G.; Jaffe, R.L.; Ross, G.G. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 18p. (T—341). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703379.

The authors confront their explanation of the "EMC effect" in which the quark confinement scale increases in going from a free nucleon to nucleus, with a new electroproduction experiment off several nuclear targets. A change of confinement scale modifies the quark and gluon distribution functions, and the authors compute, in leading order in QCD, its effects for a series of different nuclei. New, precise electron scattering measurements at SLAC agree well with these predictions supporting the postulate that the confinement size increases with nuclear density.

5942 **(RAL—84-029) Dynamical rescaling and universality of hadron structure functions.** Close, F.E.; Roberts, R.G.; Ross, G.G. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 8p. (T—342). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703380.

The authors argue that pion and nucleon structure functions differ principally due to their different numbers of quarks and different scales of confinement. The former generates an x rescaling while the latter, in QCD, gives rise to a Q^2 rescaling. Together these lead to the relation Fsub(π)(x, Q^2) = Fsub(N)(2/3) x, zetasub(Nπ) (Q^2) with zetasub(Nπ) approx.= 0.16, for x values away from the end points. This relation is in good agreement with data.

5943 **(RAL—84-038) Dynamical rescaling, the EMC effect and universality of hadron structure functions.** Close, F.E. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE84703381.

From 19. Moriond meeting; La Plagne, France (Mar 1984).

Data are compared on the EMC effect, with the hypothesis that the quark confinement size increases in going from a free nucleon to a nucleus. In QCD a dynamical rescaling is predicted: Q^2 variation of the distribution function in a given target parallels the dependence on confinement size, R, at fixed Q^2. Thus a dynamical scale invariance obtains when both R and Q^2 are varied, yielding the dynamical rescaling relation F²sup(A)(x, Q^2) = F²sup(N)(x, zetaQ^2) where zeta > 1 is predicted for any nucleus and is a function of the confinement size. Data on 12 nuclei agree with this, implying that confinement size is governed by nuclear density. The formalism is tested by relating the pion and nucleon structure functions.

5944 **(UCRL—91421) Tests of effective interactions for nucleon scattering and charge exchange below 60 MeV.** Dietrich, F.S.; Petrovich, F. (Lawrence Livermore National Lab., CA (USA); Florida State Univ., Tallahassee (USA)). Nov 1984. Contract W-7405-ENG-48. 19p. (CONF-840945—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003200.

From Topical conference on neutron-nucleus collisions--a probe of nuclear structure; Glouster, OH, USA (5 Sep 1984).

Significant progress has been made over the past several years in developing energy-and density-dependent effective interactions and optical potentials based on free nucleon-nucleon potentials. This leads to the hope that the nucleon-scattering reaction mechanism may be well enough to probe details of nuclear spectroscopy (i.e., transition densities) more accurately than with purely phenomenological approaches. Of particular interest to this conference is the possibility of separating neutron and proton transition densitiies by comparing proton and neutron scattering, which can be done reliably only if the isovector parts of the effective interaction are well known. This paper attempts to assess the accuracy of presently available interactions through comparisons with elastic and inelastic scattering over a wide mass range, and also the (p,n) isobaric-analog reaction. Particular emphasis has been placed on the isovector parts of the interaction and on Coulomb corrections by comparing proton and neutron scattering on the same targets. In a number of cases, precise neutron data have been measured to facilitate these comparisons. 46 references.

5945 **(WIS-PH—83/30) Non-degenerate single-particle energies in the Ginocchio model.** Leviatan, A.; Kirson, M.W. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). Jul 1983. 43p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703378.

A one-body operator expressing the breaking of the degeneracy of the single-nucleon energies is added to the pairing interaction of the Ginocchio model. This operator couples states inside the model's S-D space to states outside it. The influence of this coupling on the effective interaction in the S-D space and the possibility of expressing the results in terms of renormalization of parameters in the fermion hamiltonian or the IBM are investigated. The effective interaction is found to be almost diagonal in seniority, while splitting the previously-degenerate seniority multiplets. appropriately renormalized Ginocchio and IBM hamiltonians can approximately reproduce the results, but fermion-number dependence of the hamiltonian parameters and explicit three-body interactions are needed to reproduce the computed effects exactly.

5946 **Pion interferometry for exploding sources.** Pratt, S. (School of Physics, University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review Letters;* **53**: No. 13, 1219-1221(24 Sep 1984). Contract AC02-79ER10364.

A formula for the two-pion correlation function is derived for an arbitrary chaotic source when the emission spectrum from each point in space-time is known. The experimental fact that pions with high momentum in the center-of-mass frame are more correlated than low-momentum pions is explained by a collective expansion of the source. A simple model illustrates how the pion correlations can be used to measure the expansion velocity of a nuclear fireball.

6540 Radiation And Shielding Physics

5947 **(AD-A—143088/3) Cherenkov radiation in the neighborhood of the emission threshold. Technical report.** Buskirk, F.R.; Neighbours, J.R. (Naval Postgraduate School, Monterey, CA (USA)). May 1984. 9p. (NPS—61-84-007). NTIS, PC A02/MF A01.

Cerenkov radiation for constant-velocity electrons in an infinite uniform dielectric has a sharp threshold for v (electron) larger than the speed of light in the dielectric. A medium of finite length produces diffraction which smears the Cherenkov emission angle and lowers the threshold velocity for emission.

5948 **(AD-A—144890/1) SANDYL radiation transport code at the Naval Research Laboratory. Interim report.** Langworthy, J.B. (Naval Research Lab., Washington, DC (USA)). 25 Jul 1984. 21p. (NRL-MR—5381). NTIS, PC A02/MF A01.

SANDYL is a Monte Carlo photon and electron transport code used mainly to calculate dose in any material. This report is a history of the translation and modification of the local version, which is being run on the Texas Instrument Advanced Scientific

Computer, and the report details how this version differs from the original versions. Together with original documentation, it will serve as a user's manual. Use of codes like SANDYL or of equivalent more expensive, experimental information is necessary in radiation vulnerability studies and hardness design work on Navy satellites. The special utility of SANDYL lies in its ability to handle rather general geometries while retaining a close connection with physical mechanism.

5949 **(CTA-IEAV-NT—007/83) Covariance matrices in the evaluated nuclear data.** Corcuera, R.P. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). May 1983. 41p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780223.

The implications of the uncertainties of nuclear data on reactor calculations are shown. The concept of variance, covariance and correlation are expressed first by intuitive definitions and then through statistical theory. The format of the covariance data for ENDF/B is explained and the formulas to obtain the multigroup covariances are given.

5950 **(ENEA-RT/FI—83-4) Size dependent diffusive parameters and tensorial diffusion equations in neutronic models for optically small nuclear systems.** Premuda, F. (ENEA, Rome (Italy)). 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700175.

Two lines in improved neutron diffusion theory extending the efficiency of finite-difference diffusion codes to the field of optically small systems, are here reviewed. The first involves the nodal solution for tensorial diffusion equation in slab geometry and tensorial formulation in parallelepiped and cylindrical gemometry; the dependence of critical eigenvalue from small slab thicknesses is also analitically investigated and finally a regularized tensorial diffusion equation is derived for slab. The other line refer to diffusion models formally unchanged with respect to the classical one, but where new size-dependent RTGB definitions for diffusion parameters are adopted, requiring that they allow to reproduce, in diffusion approach, the terms of neutron transport global balance; the trascendental equation for the buckling, arising in slab, sphere and parallelepiped geometry from the above requirement, are reported and the size dependence of the new diffusion coefficient and extrapolated end point is investigated.

5951 **(FEI—1486) BRAND program complex. Part 1. Preparation of general information, definition of a source and geometry of a system.** Androsenko, A.A.; Androsenko, P.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE84703305.

A description is given of the structure, input procedure and recording rules of initial data for the BRAND programme complex intended for the Monte Carlo simulation of neutron physics experiments. The BRAND complex ideology is based on non-analogous simulation of the neutron and photon transport process (statistic weights are used, absorption and escape of particles from the considered region is taken into account, shifted readouts from a coordinate part of transition nucleus density are applied, local estimations, etc. are used). The preparation of initial data for three sections is described in detail: general information for Monte Carlo calculation, source definition and data for describing the geometry of the system. The complex is to be processed with the BESM-6 computer;; the basic programming language is FORTRAMN; volumree is more than 8000 operators.

5952 **(IFIN-NP—22-1981) Assembler absolute forward thick-target bremsstrahlung spectra program.** Niculescu, V.I.R.; Baciu, G.; Ionescu-Bujor, M. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1981. 25p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700176.

The program is intended to compute the absolute forward thick-target bremsstrahlung spectrum for electrons in the energy range 1-24 MeV. The program takes into account the following phenomena: multiple scattering, energy loss and the attenuation of the emitted gamma rays. The computer program is written in Assembler having a higher degree of generality and is more performant than the FORTRAN version.

5953 **(INP—1181/AP) Thermal neutron absorption cross-section for small samples (experiments in cylindrical geometry).** Czubek, J.A.; Drozdowicz, K.; Igielski, A.; Krynicka-Drozdowicz, E.; Woznicka, U. (Institute of Nuclear Physics, Krakow (Poland)). 1982. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703367.

Measurement results for thermal neutron macroscopic absorption cross-sections Σsub(a)1 when applying the cylindrical sample-moderator system are presented. Experiments for liquid (water solutions of H_3BO_3) and solid (crushed basalts) samples are reported. Solid samples have been saturated with the H_3BO_3 "poisoning" solution. The accuracy obtained for the determination of the absorption cross-section of the solid material was $\sigma(\Sigma sub(ma))=(1.2+2.2)$ c.u. in the case when porosity was measured with the accuracy of $\sigma(phi)=0.001+0.002$. The dispersion of the Σsub(ma) data obtained for basalts (taken from different quarries) was higher than the accuracy of the measurement. All experimental data for the fundamental decay constants lambda$_0$ together with the whole information about the samples are given.

5954 **(JAERI-M—83-144) Algorithm for solving three-dimensional neutron transport problems by the Galerkin-type double finite element method.** Fujimura, Toichiro; Nakahara, Yasuaki; Matsumura, Masahiro. (Japan Atomic Energy Research Inst., Tokyo). Sep 1983. 44p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703308.

This report describes in detail an algorithm for solving static multi-group neutron transport problems in the three-dimensional geometry by the Galerkin method based on a double finite element method (DFEM) and its characteristics. The formulation involves the use of a combination of triangular and guadrangular prism elements to simulate the practical reactor configurations as accurately as possible, and six bases with coupling in the angular space to represent the angular distribution of the neutron flux smoothly. The present method is characterized by the explicit representation of boundary condition, and by the iteration which sweeps the node points successively through planar layers. New proposition is given to accelerate the convergence. A computer code has been written on the basis of the method mentioned above. The information on the program structure is given also. In addition, on the basis of the experiences in the calculations including real scale problems, the characteristics of the DFEM solutions are shown in comparison with other finite difference codes.

5955 **(SAND—84-1099) Self-Optimized Sector (SOS) model of self-consistent energy loss and scattering for an electron beam propagating in air.** Vittitoe, C.N.; Clark, R.E. (Sandia National Labs., Albuquerque, NM (USA); Mission Research Corp., Albuquerque, NM (USA)). Sep 1984. Contract AC04-76DP00789. 28p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003161.

A method is described to extend Self-Optimized Sector (SOS) code capabilities to treat electron-beam propagation in air. The addition allows self-consistent simulation that includes the effects of air conductivity. Expressions are found for fast computer evaluation of the energy loss and multiple scattering experienced by beam particles during each time step. The fast expressions are limited to the electron parameter range $1.02 \leq \gamma^2 \leq 41$. The energy loss is used to drive air-ion equations that create an air conductivity. Because air pressures are restricted to > 4 Torr, the conductivity is modeled as a collision-dominated plasma. A cutoff energy of 10 keV is imposed. Smaller energy electrons are forced to deposit their kinetic energy within the cell during the current timestep. The ionization energy loss within a cell is shared among the eight corners of the cell to smooth the distribution.

5956 **Observation of electric synchrotron radiation in a crystal.** Cue, N.; Marsh, B.B.; Pisharody, M.; Sun, C.R.; Bian, Z.H.; Lin, I.C.; Park, H.; Gearhart, R.A.; Murray, J.J. (Department of Physics, State University of New York at Albany, Albany, New York 12222). *Physical Review Letters;* 53: No. 10, 972-974(3 Sep 1984).

Enhanced radiation of up to 0.4 of the incident beam energy, measured for 4-, 15-, and 17.5-GeV positrons directed along the

<100> axis of an 80-μm-thick diamond crystal, is reported for the first time. The results are in excellent agreement with the recently proposed theory of crystal-assisted radiation based on the synchrotron formalism.

5957 **Fitted temperature-corrected Compton cross sections for Monte Carlo applications and a sampling distribution.** Wienke, B.R.; Devaney, J.J.; Lathrop, B.L. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Science and Engineering;* **88**: No. 1, 71-76(Sep 1984).

Simple temperature-corrected cross sections, which replace the static Klein-Nishina set in a one-to-one manner, are developed for Monte Carlo applications. The reduced set is obtained from a nonlinear least-squares fit to the exact photon-Maxwellian electron cross sections by using a Klein-Nishina-like formula as the fitting equation. Two parameters are sufficient, and accurate to two decimal places, to explicitly fit the exact cross sections over a range of 0 to 100 keV in electron temperature and 0 to 1 MeV in incident photon energy. Since the fit equations are Klein-Nishina-like, existing Monte Carlo code algorithms using the Klein-Nishina formula can be trivially modified to accommodate corrections for a moving Maxwellian electron background. The simple two parameter scheme and other fits are presented and discussed and comparisons with exact predictions are exhibited. The fits are made to the total photon-Maxwellian electron cross section and the fitting parameters can be consistently used in both the energy conservation equation for photon-electron scattering and the differential cross section, as they are presently sampled in Monte Carlo photonics applications. The fit equations are motivated in a very natural manner by the asymptotic expansion of the exact photon-Maxwellian effective cross-section kernel. A probability distribution is also obtained for the corrected set of equations.

5958 **Potential and stopping power information from ion channeling in Ge.** Culbertson, R.J.; Withrow, S.P.; Barrett, J.H. (Oak Ridge National Lab., TN (USA). Solid State Div.). *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 19-24(Mar 1984). (CONF-830780—). Contract W-7405-ENG-26.

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

Ion scattering spectra have been obtained for planar and near-planar channeling of He^+ in germanium. Strong yield oscillations are observed in the energy spectra of the backscattered ions. The wavelength and stopping power of the incident ions have been determined from measurements of the energy separation between yield oscillations from spectra taken with various entrance and exit angles. The angle of inclination of the beam direction to the planes that produces the maximum scattering yield was also measured. This allowed the determination of the wavelength and stopping power by a second method. The wavelengths and angles for maximum scattering yields also provide information about the strength of the interaction potential between the ions and the target atoms.

6550 Medical Physics

REFER ALSO TO CITATION(S) 6550004685, 5208, 5209, 5210, 5211, 5212, 5213, 5214, 5215, 5216, 5217, 5218, 5222, 5223, 5224, 5225, 5227, 5228, 5229, 5230, 5234, 5235, 5236, 5237, 5239, 5240, 5241, 5242, 5243, 5343, 5344, 5408, 5409, 5410, 5451, 5453, 5459, 5480, 5481, 5482, 5485, 5488, 5489, 5490, 5491, 5492, 5493, 5494, 5495, 5496, 5497, 5498, 5499, 5500, 5501, 5502, 5503, 5504, 5505, 5506, 5507, 5508, 5511, 5512, 5513, 5514, 5551, 5562, 5564

5959 (FS—83-30-T, pp 29-41) **Radiation protection principles, their impact on practical dose monitoring.** Burger, G.; Drexler, G.; Jacobi, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

The two leading principles of radiation protection call for an optimization of the use of ionizing radiation in terms of economics, and for a cut-back of personal dose. As to the latter, there are no criteria of acceptability, only for collective mean values. Assessments are based on models of occupational radiation exposure and dose distribution, which have to be verified by practical radiation protection monitoring. The health hazards to be assessed for all types of radiation and all types of exposure alike are expressed in terms of effective equivalent dose for which primary dose limits are given. This quantity cannot be measured directly. For practical radiation protection therefore, so-called operational quantities are defined, sometimes with appropriate limiting values, i.e. for the most part conservative equivalent quantities which are easy to determine. The new operational quantities to be applied for external irradiation are all defined in the 30 cm ICRU sphere. Due to their non-additivity, index quantities cannot be used. Instead, use of depth doses on a defined spherical axis for axially parallel radiation beams is recommended. The conditions governing internal radiation exposure are of special interest. Limits of annual intakes of radionuclides (ALI) have been determined by the ICRP which can be used to derive limits of body doses.

5960 (FS—83-30-T, pp 43) **Principles, quantities and units of radiation protection measurement.** Harder, D. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5961 (FS—83-30-T, pp 55-71) **National and international radiation protection standards.** Becker, K.; Erdtmann, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

National and international technical codes and standards reflect the current state of the art in technology. They are the result of careful work carried out jointly by experts of various bodies and organisations (as for instance public authorities, industry, research institutions, technical control boards, etc.), and are agreed upon after a complicated and well-proven procedure of consensus finding. This procedure is explained using as an example the following institutions: The DIN Deutsches Institut fuer Normung e.V., which has several standardization committees (for radiology, nuclear engineering, electrical engineering, etc.) and hitherto has set up some 120 radiation protection standards. The ISO Technical Committee 85, 'Nuclear Engineering', of which the sub-committee 2, 'Radiation Protection', consists of eight working groups including members of the Federal Republic of Germany. About 15 standardization projects are placed under the responsibility of this sub-committee. The Technical Committee 45 of IEC, which the sub-committee 45 B is elaborating standards for radiation protection measuring equipment. Most of these standards have been adopted as national DIN standards in the FRG.

5962 (FS—83-30-T, pp 105-107) **Secondary standard laboratory for photon and beta radiation of the GSF.** Eckerl, U.; Nahrstedt, U.; Drexler, G. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5963 (FS—83-30-T, pp 109-112) **Calibration of radiation protection dosemeters for photon radiation with a dose rate of about 1 μSv/h.** Duftschmid, K.E.; Hizo, J.; Strachotinsky, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

This paper explains the use of a new secondary standard ionisation chamber which is coupled to a primary standard source for X- and gamma radiation and thus allows direct calibration of

dosemeters for a dose rate of 1 μ Sv/h up to 1 Sv/h for use in radiation protection.

5964 (FS—83-30-T, pp 117-120) **Effects of scattered neutrons on the calibration of radiation detectors using radioactive neutron sources.** Kluge, H.; Rasp, W. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Radiation detectors for radiation protection purposes can be calibrated using radioactive neutron sources, if the equivalent dose rate H is known, produced by the neutrons under defined conditions at the measuring site. The calibration factor then is $\dot{N}=H/M$, with M being the data shown by the measuring device. This factor is valid for measurements carried out under conditions identical to those of the calibration. The measuring device, however, will not only detect those neutrons coming directly from the neutron source but also those being scattered from the walls, structures and air. This scattered neutron fraction also comprised in the indication of a spherical Rem counter has been measured behing a shadow cone for two rooms of different size, and compared with values resulting when assuming constant spatial dimensions. The observed variation of scattered fraction with varying distance from the source and the resulting modification of the calibration factor relative to the value derived by the shadow cone measurements is explained and discussed.

5965 (FS—83-30-T, pp 121-124) **Calibration of albedo-neutron personnel dosemeters.** Knoefel, T.M.J.; Schraube, H. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

5966 (FS—83-30-T, pp 153-156) **Comparison of requirements to be met by personnel dosimetry record offices in the FRG and in Switzerland.** Boehm, J.; Wernli, C. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

On January 1, 1982 the 'Statutory order on the approval and management of personnel dosimetry record offices' came into force in Switzerland. This order is compared with the corresponding provisions in the FRG, namely the regulation setting the 'Requirements for offices authorised under Land legislation to fulfill the duties of an official measuring and recording office within the purview of section 63, sub-section (3), sentence 1 of the Radiation Protection Ordinance, and section 40, sub-section (2) of the X-ray Ordinance'. The main characteristics are compared, and identical, especially differing regulations are shown.

5967 (FS—83-30-T, pp 173-176) **Numerical method for precise energy dose determination after upsilon-point irradiation of tissue-equivalent, cylindrical samples.** Brandenburg, K. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

A computer-aided method of approximation is presented by which the energy dose in tissue-equivalent, cylindrical samples (particularly suited for dosemeter systems) can be determined. The method is based on ion dose measurement in secondary electron equilibrium; it is fast and precise (accuracy < 2%) and therefore well suited for radiation protection purposes and in radiobiology.

5968 (FS—83-30-T, pp 211-216) **Legal regulations governing workplace monitoring in radioisotope laboratories.** Hardt, H.J. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Legal regulations governing workplace monitoring in radioisotope laboratories are presented and compared on the basis of the West German and Swiss Radiation Protection Ordinances and the pertinent EC standards. The following subjects are covered: Application of the fundamentals of radiation protection; requirements to be met for licenses to handle radioisotopes; classification of monitored areas; requirements on radiation monitoring. The possible consequences of the new ICRP recommendations are discussed.

5969 (FS—83-30-T, pp 217-230) **Practical aspects of workplace monitoring, illustrated by the example of a modern radionuclide laboratory.** Wegner, L. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

An outline of the design concept and functions of a newly constructed radionuclide laboratory is followed by a description of radiation protection and monitoring measures envisaged. Radiation doses greatly exceeding the limiting values should be measured as quickly as possible and long-term deviations from standard values as accurately as possible. The potentialities and limitations of monitoring by means of a computer-aided, central monitoring system are discussed as well as the practicability of some of the measures envisaged.

5970 (FS—83-30-T, pp 231-238) **Technical features of workplace monitoring instruments.** Maushart, R. Jun 1983. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number TI85750007. (CONF-8210309—; GSF—A4/83).

From 16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods; Muniich, F.R. Germany (19 Oct 1982).

Workplace monitoring comprises measurements of the local dose rate, measurements of the contamination of surfaces, persons and objects, and measurements of the activity levels of the room air. Measurements of radioactivity levels of waste water and waste air, although they are to protect the population rather than the laboratory staff, are part of an integral monitoring concept.

5971 **(ZJE—266) Set of programs for determining exposure and dose rates from selected sources of gamma radiation.** Hep, J.; Kralovcova, E.; Smutny, V.; Valenta, V. (Skoda, Plzen (Czechoslovakia). Zavod Vystavba Jadernych Elektraren). 1982. 100p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85780207.

The programs are described for the determination of exposure and dose rate of gamma radiation from point, surface, linear and volume sources with and without shielding. The computation is conducted using the classical method taking into consideration the buildup factor. For the computation of the buildup factor in heterogeneous shielding the Broder and Kitazuma formulas are used. Kitazuma's alpha coefficients were calculated recurrently using a new semi-empirical method. Taylor's approximation was used for the calculation of the buildup factor in a single layer.

6560 Solid State Physics

5972 **(AD-A—142991/9) Solid state research. Quarterly technical report 1 August-31 October 1983.** McWhorter, A.L. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 15 Nov 1983. 86p. NTIS, PC A05/MF A01.

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1983. The topics covered are Solid

State Device Research, Quantum Electronics, Materials Research, Microelectronics, and Analog Device Technology. Funding is primarily provided by the Air Force, with additional support provided by the Army, DARPA, Navy, NASA, and DOE.

5973 **(BONN-HE—84-4) Corrections to finite-size scaling for quantum chains.** Gehlen, G. von; Hoeger, C.; Rittenberg, V. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Feb 1984. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750005.

We compute the leading order correction to the energy gap at the critical point for the anisotropic Ising and the Z_5 Potts quantum chains. Periodic, anti-periodic and open boundary conditions are considered. For the Ising case the corrections are independent of the boundary conditions. In the Z_5 case the correction is the same for anti-periodic and open boundary conditions but is 2/5 smaller for the periodic case. We have no explanation for this phenomenon.

5974 **(DOE/ER/10750—T2) Surface physics and crystallography. Technical progress report, 1 November 1983-31 October 1984.** Jona, F.P. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering). 1984. Contract AC02-80ER10750. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003129.

This report concerns research on surface physics and crystallography that was carried out at the National Synchrotron Light Source (NSLS). The writer is a member of the participating research team (PRT) that operates beam line U7. This PRT includes three groups: two from Brookhaven National Laboratory (M. Strongin from the Physics Department and T. K. Sham from the Chemistry Department) and one from the State University of New York at Stony Brook (F. Jona from the Department of Materials Science and Engineering). The items presented in this report are: in section II, a list of the scientific papers produced during the current year and published or submitted for publication or presented at scientific meetings; in section III a description of the scientific projects undertaken and of the results obtained.

5975 **(IC—83/187) Stochastic quantization and mean field approximation.** Jengo, R.; Parga, N. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700043.

In the context of the stochastic quantization we propose factorized approximate solutions for the Fokker-Planck equation for the XY and Zsub(N) spin systems in D dimensions. The resulting differential equation for a factor can be solved and it is found to give in the limit of t→infinity the mean field or, in the more general case, the Bethe-Peierls approximation.

5976 **(IC—83/211) Equivalence between the discrete Gaussian model and a generalized Sine Gordon theory on a lattice.** Baskaran, G.; Gupte, N. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700044.

We demonstrate an equivalence between the statistical mechanics of the discrete Gaussian model and a generalized Sine-Gordon theory on an Euclidean lattice in arbitrary dimensions. The connection is obtained by a simple transformation of the partition function and is non perturbative in nature.

5977 **(IC—83/212) Susceptibility of a Heisenberg antiferromagnet.** Agarwal, B.K.; Singh, N. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700045.

The spin-wave Hamiltonian for the two sublattice Heisenberg antiferromagnet is obtained using a Maleev transformation. The dipole-dipole interaction is restricted to nearest neighbours. The double-time Green function formulation is used to obtain the expression, up to first order, of the sixteen elementary two-operator Green functions. These are used to obtain the frequency-dependent susceptibility.

5978 **(IS-M—523) Nature of electronic wave functions in disordered systems.** Soukoulis, C.M.; Economou, E.N. (Ames Lab., IA (USA); Crete Univ., Rethymnon (Greece). Dept. of Physics). 1984. Contract W-7405-ENG-82. 10p. (CONF-8411117—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003066.

From 12. midwest solid state theory symposium; Minneapolis, MN, USA (29 Nov 1984).

The question of how to quantitatively characterize the wave functions in disordered systems is examined. We discuss the following relevant quantities: the phase coherence length l, the localization length λ, the amplitude fluctuation length ξ, the participation ratio p and the fractal dimensionality D. Various techniques for calculating these quantities are mentioned and relevant results are presented. 12 references.

5979 **(RAL—84-030) Polarisation analysis of neutron scattering from crystal field levels.** Lovesey, S.W.; Gunn, J.M.F. (Rutherford Appleton Lab., Chilton (UK)). Apr 1984. 5p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700046.

The authors argue that polarisation analysis of scattering of an unpolarised beam from a single crystal is a useful technique for looking at crystal field excitations. A general expression for the polarisation in the scattered beam is presented and two illustrative examples worked out.

5980 **(RL—83-118) Lectures on magnetism and neutron scattering.** Gunn, J.M.F. (Rutherford Appleton Lab., Chilton (UK)). Dec 1983. 49p. (RAL—83-118). NTIS (US Sales Only), PC A03/MF A01. File Number DE85700048.

The paper contains six lectures given to the Neutron Division of the Rutherford Appleton laboratory in 1983. The aim was to explain fundamental physics of neutron scattering and basic magnetism to the non-specialist scientist. The text includes: origin of neutron's magnetic moment and spin-dependent interactions with electrons and nuclei, why are solids magnetic, magnetic anistropy and domain structure, phenomenological spin waves, magnetic phase transitions and electronic excitations in magnets.

5981 **GeV channeling in bent crystals with slowly varying curvature.** Ellison, J.A. (New Mexico Univ., Albuquerque (USA)); Baker, S.I.; Carrigan, R.A. Jr. (Fermi National Accelerator Lab., Batavia, IL (USA)); Forster, J.S.; Mitchell, I.V. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Gibson, W.M.; Kim, I.J.; Pisharody, M.; Salman, S.; Sun, C.R. *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms;* **230**: No. 1-3, 9-12(Mar 1984). (CONF-830780—).

From International conference on atomic collisions in solids; Bad Iburg, F.R. Germany (18 Jul 1983).

In a recent Fermilab experiment, the deflection of charged particles by planar channeling in bent single crystals in the 100 GeV/c regime was observed. The experiment shows the necessity of taking into account the variation of curvature along the bend. Here a theory is developed to treat the case of slowly varying curvature and it is shown that the predictions are in qualitative agreement with the experimental data.

6561 Superconductivity

REFER ALSO TO CITATION(S) 6561004912, 4921, 4966, 4967, 6002

5982 **Resonant activation from the zero-voltage state of a current-biased Josephson junction.** Devoret, M.H.; Martinis, J.M.; Esteve, D.; Clarke, J. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **53**: No. 13, 1260-1263(24 Sep 1984). Contract AC03-76SF00098.

The lifetime tau of the zero-voltage state of a current-biased Josephson junction in the thermal limit has been measured in the

presence of a weak microwave perturbation. When the microwave frequency is close to the plasma frequency of the junction, the junction is "resonantly activated" out of the zero-voltage state, with a corresponding reduction in tau. The results are well explained by numerical simulations.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 6570005630, 5631, 5636, 5758, 5764, 5978, 6002, 6002, 6004, 6008

5983 (BNL—35476) Boundary parametric approximation to the linearized scalar potential magnetostatic field problem. Bramble, J.H.; Pasciak, J.E. (Cornell Univ., Ithaca, NY (USA); Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85003515.

We consider the linearized scalar potential formulation of the magnetostatic field problem in this paper. Our approach involves a reformulation of the continuous problem as a parametric boundary problem. By the introduction of a spherical interface and the use of spherical harmonics, the infinite boundary conditions can also be satisfied in the parametric framework. That is, the field in the exterior of a sphere is expanded in a harmonic series of eigenfunctions for the exterior harmonic problem. The approach is essentially a finite element method coupled with a spectral method via a boundary parametric procedure. The reformulated problem is discretized by finite element techniques which lead to a discrete parametric problem which can be solved by well conditioned iteration involving only the solution of decoupled Neumann type elliptic finite element systems and L^2 projection onto subspaces of spherical harmonics. Error and stability estimates given show exponential convergence in the degree of the spherical harmonics and optimal order convergence with respect to the finite element approximation for the resulting fields in L^2. 24 references.

5984 (DOE/ER/10947—3) Bifurcations and fluctuations in far-from-equilibrium systems. Progress report 1983-1984. (Texas Univ., Austin (USA). Center for Studies in Statistical Mechanics). 1984. Contract AS05-81ER10947. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003026.

Progress is reported on the following studies: (1) the effects of random and periodic perturbations on nonlinear systems, (2) sensitivity of nonequilibrium systems, (3) simulation methods and modeling of complex chemical systems, (4) study of spatial correlations and stochastic behavior in nonequilibrium chemical systems, and (5) complex bifurcations in nonlinear dynamical systems. (WHK)

5985 (IC—83/149) Exact path integral solution of the Morse potential. Pak, N.K.; Sokmen, I. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700009.

The exact Feynman propagator for the Morse potential is calculated by using the recently developed generalized new-time formalism.

5986 (IC—83/178) Path integral representation of the symmetric Rosen-Morse potential. Duru, I.H. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700011.

An integral formula for the Green's function of symmetric Rosen-Morse potential is obtained by solving path integrals. The correctly normalized wave functions and bound state energy spectrum are derived.

5987 (IC—83/208) Kaluza Klein cosmology. Randjbar-Daemi, S.; Salam, A.; Strathdee, J. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700060.

A generalization of Friedmann-Robertson-Walker cosmology to 4+K dimensions is considered. The space-time manifold $R^1 x S^3 x S sup(K)$ is characterized by two time-dependent scales, R(t) and a(t). The equations of motion for R and a are derived from the 4+K-dimensional Einstein action supplemented by a one-loop thermal term, corresponding to a gas of non-interacting scalar particles. It is shown that in the approximation when $T < 1/a$ the equations of motion admit a solution in which the internal space has a constant radius a, while the external R(t) evolves in the usual manner.

5988 (IFIN-FT—222-1982) New proof of Wigner's theorem. Purice, R. (Institutul Central de Fizica, Bucharest (Romania)). Dec 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700151.

In this paper I shall give an elementary, analytic proof of Wigner's theorem by directly proving that the linear extension of an isomery between two projective spaces to the algebras of finite rank operators is multiplicative or antimultiplicative.

5989 (IFTAR-LOP—43-1984) Phase space treatment of optical beams. Nemes, G.; Teodorescu, I.E.; Nemes, M. (Institutul Central de Fizica, Bucharest (Romania)). Jan 1984. 36p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700152.

The lecture reveals the possibility of treating optical beams and systems using the PS concept. In the first part some well-known concepts and results of charged particle optics are applied to optical beam and systems. Attention is paid to the PSE concept as to being a beam invariant according to Liouville's theorem. In the second part some simple optical sources, their PSE and their transforms through simple optical elements are theoretically presented. An experimental method and a device for PSE measurements are presented in the third part. In the fourth part the main problems of the linear system theory which were applied to electrical circuits in the time (or frequency) domain and to optical systems in the bidimensional space of spatial coordinates (or spatial frequencies) are applied to stigmatic optical systems in the bidimensional PS (spatial coordinate, angle). Some examples of applying PS concepts in optics are presented in the fifth part. The lecture is mainly based on original results some of them being previously unpublished.

5990 (KFKI—1984-33) Thermodynamics of negative absolute pressures. Lukacs, B.; Martinas, K. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Mar 1984. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700070.

The authors show that the possibility of negative absolute pressure can be incorporated into the axiomatic thermodynamics, analogously to the negative absolute temperature. There are examples for such systems (GUT, QCD) processing negative absolute pressure in such domains where it can be expected from thermodynamical considerations. 28 refs.

5991 (KFKI—1984-43) Quantum relativity theory and quantum space-time. Banai, M. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Apr 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700020.

To appear in Int. J. Theor. Phys. (1984).

A quantum relativity theory formulated in terms of Davis' quantum relativity principle is outlined. The first task in this theory as in classical relativity theory is to model space-time, the arena of natural processes. It is argued that the quantum space-time models of Banai is formulated in terms of Davis' quantum relativity. Then it is shown that the recently proposed classical relativistic quantum theory of Prugovecky and his corresponding classical relativistic quantum model of space-time open the way to introduce, in a consistent way, the quantum space-time model (the 'canonically quantized Minkowski space') of Banai. The main new aspect of the quantum mechanics of the quantum relativistic particles, in this model of spacetime, is that it provides a true mass eigenvalue problem, and that the excited mass states of such particles can be interpreted as classically relativistic (massive) quantum particles ('elementary particles'). The question of field theory over quantum relativistic models of space-time is also discussed. Finally, it is suggested that 'quarks' should be considered as quantum relativistic particles. 35 refs.

5992 **(KFKI—1984-62) Identification of gravitation with the massless spin 2 field.** Meszaros, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700021.

The identification of gravitation with the massless spin 2 gauge field (the gauge group is the group of translations) requires to restrict the solutions of Einstein's equations to the class of topologically trivial manifolds. It is shown that the validity of this restriction in nature is supported by the present-day empirical facts. The identification has a drastic impact on cosmology, because the fulfilment of the cosmological principle seems to be improbable. 52 refs.

5993 **(KFKI—1984-64) Einstein-Cartan's theory of gravitation.** Meszaros, A. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). May 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700023.

The Einstein-Cartan theory of gravitation is an extended version of general relativity assuming the existence of Cartan's contorsion, the antisymmetric part of Christoffel symbols. The theory is intensively studied recently, but the physical meaning of contorsion was not clear earlier. The present paper discusses this question and shows that contorsion is determined in general case by a pair of self-interacting massless spin-2 fields and by other extraordinary vector fields. The spin-2 fields are the gauge fields of Lorentz group. 5 refs.

5994 **(LA-UR—84-3057) Imaging through a multiple scattering medium.** Zardecki, A.; Gerstl, S.A.W.; Embury, J.F. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 5p. (CONF-8406152—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002051.

From CRDC scientific conference on obscuration and aerosol research; Baltimore, MD, USA (25 Jun 1984).

The existing theory of imaging through an aerosol medium, based on the small-angle approximation to radiative transfer, is extended to the general case of multiple scattering with an arbitrary degree of anisotropy. By applying the discrete-ordinates, finite-element radiation transport code TWOTRAN, we compute the modulation transfer function for a medium characterized by optical depth, single scattering albedo, and a symmetry parameter. An extended version of this investigation will appear in a 1984 issue of Applied Optics.

5995 **(SLAC/AP—31) Note on the field of a fast, charged particle.** Lippmann, B.A. (Stanford Linear Accelerator Center, CA (USA)). Aug 1984. Contract AC03-76SF00515. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002588.

As the velocity of a charged particle increases, its electric flux lines become more and more concentrated about the transverse plane. This picture is sometimes construed to mean that the electric field is zero in front of a very fast particle. For many purposes, this is a valid approximation, but we must remember that it is still an approximation. No matter what the velocity of the particle, the field ahead of it never is zero. This becomes apparent if the field component along the direction of motion is integrated over the transverse plane. Here, Gauss' Theorem constrains the longitudinal field component to be finite, and the approximation that sets it equal to zero breaks down.

5996 **(TRI-PP—83-55) Wigner's function and other distribution functions in mock phase spaces.** Balazs, N.L.; Jennings, B.K. (TRIUMF, Vancouver, British Columbia (Canada)). Jun 1983. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700012.

This review deals with the methods of associating functions with quantum mechanical operators in such a manner that these functions should furnish conveniently semiclassical approximations. We present a unified treatment of methods and result which usually appear under the expressions Wigner's functions, Weyl's association, Kirkwood's expansion, Glauber's coherent state representation, etc.; we also construct some new associations. The mathematical paraphernalia are collected in the appendices.

5997 **(UWThPh—84-27) Perihelion shift and level ordering.** Baumgartner, B. (Vienna Univ. (Austria)). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700013.

Properties of central potentials which determine a definite level ordering in quantum mechanics are shown to determine definite perihelion shifts of classical orbits. These properties are super- or subharmonicity of the potential off the origin and convexity or concavity as a function of the radius squared. As an analogy to quantum mechanical term labelling a labelling of classical orbits is introduced and it is shown how the perihelion shift implies a definite 'labelling ordering' for the classical orbits as well as a definite level ordering within the domain of the WKB approximation.

5998 **(UWThPh—84-28) Solving the Schroedinger equation for bound states.** Falkensteiner, P.; Grosse, H.; Schoeberl, F.; Hertel, P. (Vienna Univ. (Austria)). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700014.

A computer program SCR 2 is described. It calculates energy levels and wave functions of a rotationally symmetric Schroedinger equation for a given potential. An iterative procedure for getting upper and lower bounds to energy values of the radial Schroedinger equation is given. A numerical integration procedure together with convexity arguments and the nodal theorem for wave functions is used.

5999 **(UWThPh—84-29) Laplacian of the potential and the order of energy levels.** Baumgartner, B.; Grosse, H.; Martin, A. (Vienna Univ. (Austria)). 1984. 11p. (CERN-TH—3946/84). NTIS (US Sales Only), PC A02/MF A01. File Number DE85700015.

We prove that for non-relativistic two-body systems the order of energy levels with the same principal Coulomb quantum number is controlled by the sign of the Laplacian of the (spherically symmetric) potential. If it is positive, the levels with larger angular momentum have lower energy. If it is negative, it is the opposite, but in the latter case a weaker condition can be derived. In numerous situations in particle and nuclear physics as well as atomic and solid state physics, the Laplacian has a definite sign.

6000 **Exact kinetics for "almost random" irreversible filling of lattices.** Evans, J.W.; Hoffman, D.K. (Ames Laboratory and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Statistical Physics;* **36**: No. 1, 65-80(Jul 1984). Contract W-7405-ENG-82.

A variety of processes can be modeled by the irreversible cooperative filling of lattice sites. We consider here cases where the filling rate is independent of the state of the surrounding sites except when all nearest neighbors are already filled (where a generally different rate operates) and indicate some applications for such choices. Exact solutions are obtained to the hierarchical form of the master equations for subconfiguration probabilities for a lattice of arbitrary dimension of coordination number. Analogous irreversible co-adsorption processes and processes with longer-range cooperative effects, also amenable to exact solution, are discussed.

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6001 **(DOE/ER/03077—228) Construction of solutions for two-dimensional Riemann problems.** Lindquist, W.B. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.). Sep 1984. Contract AC02-76ER03077. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85003136.

Solutions to the scalar quasilinear equation with initial data given by a two dimensional Riemann problem are piecewise smooth if f_1 identical with f_3 identical with f, and f has at most one inflection point. We show the pieces of this solution can be classified and are expressible in terms of two dimensional non-linear waves in analogy with the non-linear rarefaction and shock waves of the Riemann problem in one spatial dimension. The two dimensional waves can be expressed in almost closed form. Explicit solutions are constructable from these waves. An application is illustrated by

calculation of the interaction of water/oil banks in two phase incompressible flow in reservoirs.

6002 **(IC—83/121) Closed time-path Green function formalism in many-body theory.** Guang-zhao Zhou; Zhao-bin Su; Bai-lin Hao; Lu Yu. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700007.

The closed time-path Green function formalism, developed by our group during recent years, is briefly reviewed. The generating functional technique, the coupled equations for the order parameter and the elementary excitations as well as the systematic loop expansion are outlined. The applications to critical dynamics, quenched random systems, nonlinear response theory, superconductivity, laser system and quasi-one-dimensional conductors are described. The theoretical approach developed can be applied to both equilibrium and non-equilibrium many-body systems.

6003 **(IC—83/142) D+XDsub(S)[X] construction from GCD-domains.** Zafrullah, M. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700001.

Let D be a GCD-domain. A prime ideal P of D is called a prime filter (PF)-prime if for all a, b elements of P, GCD(a,b) is an element of P. It is proved in this paper that, if S is a multiplicative set in D, then Tsup((S))=D+XDsub(S)[X] = the set a_0+ Σasub(i)xsup(i) for a_0 an element of D and the asub(i) elements of Dsub(S) is a GCD domain if and only if for each PF-prime P of D with P intersection S=empty set there exists d an element of P such that d is not divisible by any non unit of S. The letters D and X denote, respectively, a commutative integral domain and an indeterminate. It is also shown that, if D is a GCD-domain and if S is a multiplicative set in D such that every PF-prime P of D which intersects S intersects it in detail, then Tsup((S)) may not be a GCD-domain but it has a certain property, which is elaborated. Methods of constructing a particular case of P-domains from GCD domains by means of the D+X Dsub(S)[X] construction are discussed. Then the construction of integral domains whose groups of divisibility are Riesz groups is addressed; it is shown that certain l.o. groups are isomorphic to direct sums of subgroups of real numbers. Finally, some direct and indirect applications of the foregoing results are discussed.

6004 **(IC—83/147) General new time formalism in the path integral.** Pak, N.K.; Sokmen, I. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1983. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700008.

We describe a general method of applying point canonical transformations to the path integral followed by the corresponding new time transformations aimed at reducing an arbitrary one-dimensional problem into an exactly solvable form. Our result is independent of operator ordering ambiguities by construction.

6005 **(IC—83/165) Nonlinear variational models for reaction and diffusion systems.** Tanyi, G.E. (International Centre for Theoretical Physics, Trieste (Italy)). Aug 1983. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700010.

There exists a natural metric w.r.t. which the density dependent diffusion operator is harmonic in the sense of Eells and Sampson. A physical corollary of this statement is the property that any two regular points on the orbit of a reaction or diffusion operator can be connected by a path along which the reaction rate is constant.

6006 **(IC—83/174) Liouville surface and new nonlinear integrable equations.** Chowdhury, A.R.; Paul, S. (International Centre for Theoretical Physics, Trieste (Italy)). Sep 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700002.

New nonlinear equations are obtained by embedding a Liouville surface in a space of larger dimension. Both the cases in which the embedding space is flat and curved are considered, and they lead to two different nonlinear equations. Lastly a new determination of the second fundamental form is indicated in which a coupled set of three nonlinear equations is obtained. In each case we also obtain the Lax pair equations.

6007 **(IC—83/186) Oscillations of first order retarded and advanced functional differential equations.** Ruan, J. (International Centre for Theoretical Physics, Trieste (Italy)). Nov 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700003.

In this paper we consider first order linear and non-linear functional differential equations with continuous distributed retarded and advanced arguments. We give some good conditions under which every solution of these equations oscillates. We generalized and improved results of Ladas and Stavroulasis [J. Diff. Egs., 44, 134(1982)] and Ruan Jiong [Chin. Ann. of Math., 5B, no. 4 (1984)].

6008 **(IC—83/189) Seven-spheres from octonions.** Lukierski, J.; Minnaert, P. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700017.

The groups SO(7), Spin 7 and Spin 7-bar are realized as transformations on octonionic sphere S^7. We consider the coset Spin $7/G_2$ describing S^7 with canonical torsion. Using three non-canonical choices of the connections on Spin $7/G_2$ one obtains the torsionless S^7=SO(8)/SO(7), the parallelizable curvatureless seven-sphere and Ricci-flat non-parallelizable seven-sphere.

6009 **(IC—83/195) Finite groups with four independent generators three of which being of odd prime order.** Yacoub, K.R. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700004.

Finite groups with two independent generators have been widely studied by several authors in the last three decades. Later on, the author studied finite groups with three independent generators when two of these generators have given orders [Pub. Math. Debrecen, 11, 32-38(1964); Nieuw Archief voor Wiskunde, Amsterdam (3), XIII, 180-191(1965)]. It is the object of the present paper to study the structure of finite groups when three of these generators have the same odd prime order p.

6010 **(IC—83/199) Differential equation for the generalized Bell function.** Sewerynski, M. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 6p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700005.

An ordinary differential equation for the generalized Bell function is given.

6011 **(IC—83/202) Nonoscillatory behaviour caused by retarded and advanced arguments for even-order functional differential inequalities and equations.** Ruan, J. (International Centre for Theoretical Physics, Trieste (Italy)). Dec 1983. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700006.

In this paper we study the nonoscillatory behaviour of even-order functional differential inequalities and equations with continuous distributed retarded and advanced arguments. For arguments we give some conditions under which these inequalities only have nonoscillatory solutions of degree 0 or n.

6012 **(LA-UR—84-3089) Functional equation for the embedding of a homeomorphism of the interval into a flow.** Beyer, W.A.; Channell, P.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 12p. (CONF-8409172—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85000655.

From International symposium on iteration theory and its functional equations; Lochau, Austria (27 Sep 1984).

A functional equation phi(ω(x)) = ω'(x) phi(x) for phi(x) is derived for the problem of finding phi so that for a given orientation-preserving everywhere-differentiable homeomorphism ω(x) of [0,1] with ω' not equal to 0, there exists a solution F(x,t) to F/sub t/(x,t) = phi(F) so that F(x,0) = x, F(x,1) = ω(x). A solution to the functional equation is given for the case where ω has a finite number of fixed points a/sub i/ with ω'(a/sub i/) not equal to 1.

The analogus equation in n-dimensional space is given. 10 references.

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7001 Plasma Research

REFER ALSO TO CITATION(S) 7001006193, 6200, 6229

6013 **(AD-A—142825/9) Advanced concepts theory annual report 1983. Memorandum report January-December 1983.** Apruzese, J.P.; Davis, J.; Duston, D.; Clark, R.W.; Rogerson, J.E. (Naval Research Lab., Washington, DC (USA)). 18 May 1984. 128p. (NRL-MR—5330). NTIS, PC A07/MF A01.

Results are presented on a variety of research activities concerned with investigating the radiative properties and x ray conversion efficiency of dense hot plasmas. In this volume are analyses, discussions and numerical simulations on scaling laws for K shell line power in Z pinch plasmas, ionization dynamics and diagnostics, atomic processes, ion beam target interactions, and the radiative behavior of mixtures and their potential application as enhanced radiators.

6014 (CONF-821124—, pp 4-7) **Laser heating of field-reversed configurations.** Carson, R.S.; Vlases, G.C. (Univ. of Washington, Seattle). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The experimental facility is a 21-cm-long solenoid with a 5.5-cm bore. The 4-cm ID quartz tube is filled with slowly flowing H_2 to 0.5-3.0 torr. Fields up to 6.5 T in 3.7 μsec are produced, with reverse-bias fields up -1.9 T. Preionization is by 40kA axial discharge 4.5 μsec before field-reversal is begun. The CO_2 laser used produces 300 to 400 J in 2 μsec, in an annular beam that can be defocused for preheating the outer edges of the plasma, or focused tightly for central-column heating and beam propagation during formation. The focusing system includes a return mirror for multiple passing of the laser energy. Diagnostics include compensated, diamagnetic flux loops, internal field probes, cross-tube and axial interferometers, fast photography, and spectroscopy.

6015 (CONF-821124—, pp 12-15) **Driven-mirror formation of a two-cell field-reversed configuration.** Sevillano, E.; Meuth, H.; Ribe, F.L. (Univ. of Washington, Seattle). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Improved plasma confinement on open field lines in field reversed configurations (FRC's) may prove to be of importance, as suggested by recent experiments on the control of the n=2 rotational instability. Multiple mirrors have been suggested as one way to accomplish this improved confinement. To study the formation of multiple-cell FRC's, driven magnetic mirrors have been added to the High Beta Q Machine (HBQM) at three axial positions along the theta pinch coil. We report here on measurements of the reconnection process in the region between the cells and also at one end of the coil.

6016 (CONF-821124—, pp 51-56) **Suppression of the n=2 rotational instability in field-reversed-configurations.** Hoffman, A.L.; Slough, J.T.; Harding, D.G. (Mathematical Sciences Northwest Inc., Bellevue, WA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Compact toroid plasmas formed in field-reversed-theta-pinches are generally destroyed after 30 to 50 μsec by a rotating n=2 instability. This instability has been controlled, and the plasma destruction avoided in the TRX-1 theta-pinch through the application of octopole magnetic fields. The decay times for loss of poloidal flux and particles are unaffected by the octopole fields. These decay times are about 100 μs based on inferences from interferometry and excluded flux measurements. The weak, rotating elliptical disturbance (controlled n=2 mode) also made possible a novel determination of the density profile near the separatrix using single-chord interferometry. The local density gradient scale length in this region was found to be about one ion gyrodiameter.

6017 (CONF-821124—, pp 75-78) **Adiabatic compression of elongated field-reversed configurations.** Spencer, R.L.; Tuszewski, M.; Linford, R.K. (Los Alamos National Lab., NM). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The simplest model of plasma dynamics is the adiabatic model. In this model the plasma is assumed to be in MHD equilibrium at each instant of time. The equilibria are connected by the requirement that they all have the same entropy per unit flux, i.e., the equilibria form a sequence generated by adiabatic changes. The standard way of computing such a sequence of equilibria was developed by Grad, but its practical use requires a fairly complicated code. It would be helpful if approximately the same results could be gotten either with a much simpler code or by analytical techniques. A one-dimensional equilibrium code is described and its results are checked against a two-dimensional equilibrium. An even simpler analytic calculation is then presented.

6018 (CONF-821124—, pp 88-91) **Mode structure of the lower hybrid drift instability in a field-reversed configuration.** Sgro, A.G.; Lilliequist, C.; Gladd, N.T.; Hewett, D.W. (Los Alamos National Lab., NM). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

We extend previous analysis of the lower hybrid drift instability in which simulations accurately calculated the analytic linear growth rate in the low drift velocity regime to include details of spatial structure.

6019 (CONF-821124—, pp 102-107) **Effects of passive coils on spheromak gross MHD instabilities.** Munson, C.; Janos, A.; Paul, S.; Wysocki, F.; Yamada, M. (Princeton Univ., NJ). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450. Contract AC02-76CH03073.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The experimental investigation of the effectiveness of figure-8 coils in stabilizing the n=1 tilting mode of spheromak plasmas in Proto S-1 A/B is extended. In addition, another coil configuration, the saddle coil, is examined.

6020 (CONF-821124—, pp 113-117) **Ion temperatures inferred from neutron measurements in TRISOPS IIX.** Wells, D.R.; Ziajka, P.; Tunstall, J. (Univ. of Miami, Coral Gables, FL). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The ion temperature history of the plasma fireball in TRISOPS IIX has been measured by comparing the time resolved neutron yield from a D-D reaction and a D-T reaction. This measurement results in a reading of ion temperature that is independent of any assumptions of plasma density or fireball volume. The results verify and clarify previously reported TRISOPS parameters. In a separate set of measurements using a D-D reaction, the ion temperature rises in 5 μs to 6 KeV with a corresponding density of 10^{16} ion/cm^3. After 8 μs it falls rapidly to 1 KeV as the density rises to 10^{17} ions/cm. The 1 KeV temperature is held for about 20 s. These temperatures and densities yield and equilibration time for ions and electrons that is long compared to the duration of the experiment.

6021 (CONF-821124—, pp 118-121) **Linear and nonlinear studies of the resistive interchange mode in the cylindrical spheromak.** DeLucia, J.; Jardin, S.C. (Princeton Univ., NJ). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The growth rates for resistive instabilities in the cylindrical spheromak are computed by using two complementary methods. The first method solves the full linearized resistive MHD equations as an initial value problem, utilizing zone packing around the mode rational surface. Resolution requirements limit this to values of the magnetic Reynolds number $S < 10^7$. The second method employs boundary layer analysis and asymptotic matching, most valid for $S \geq 10^5$. The 6th order resistive inner region equations are solved numerically as an asymptotoic boundary value problem. These solutions are matched onto a numerical solution of the ideal Euler equations in the outer region. The general matching condition involves even and odd parity modes with complex frequency, and includes both interchange and tearing forces. The inner region equations and matching condition have also been generalized to toroidal geometry with multiple rational surfaces. The nonlinear time development of the m=1 resistive interchange mode in the cylindrical spheromak is studied using a compressible, single helicity resistive MHD mode.

6022 (CONF-821124—, pp 129-134) **Injection of intense ion beam into a tokamak.** Robertson, S.; Katzenstein, J. (Univ. of California, Irvine). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

We describe an experiment to investigate the direct injection of an intense ion beam into a tokamak by means of the polarization drift. Confinement of 100 keV ions in the UCI tokamak (r = 15 cm, R = 60 cm, B/sub T/ = 6 kG) requires operation with a plasma current of 56 kA corresponding to q (limiter) = 2. Trapped ions are to be detected by a charge-exchange analyzer. The present status of the experiment will be discussed.

6023 (CONF-821124—, pp 135-138) **MeV and GeV prospects for producing a large ion layer configuration for fusion power generation and breeding.** McNally, J.R. Jr. Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Injection of multi-MeV molecular hydrogen ions into a magnetic mirror or magnetic mirror well can lead to the production of an ion (or proton-E) Layer with prospects for fusion power generation. This involves: (1) slow (exponential or Lorentz) trapping of protons from dissociation and/or ionization of H_3^+ ions; (2) electron cyclotron drive of the electronic temperature to reduce the electron stopping power; (3) production of an Ion-Layer, E-Core plasma configuration having prospects for cold fuel feed with in situ axial acceleration of say D_3^+ ions into the negative E-Core; (4) ignited advanced fuel burns in the resulting high beta plasma with excess (free) neutrons available for energy multiplication of fissile fuel breeding; (5) development of a nuclear dynamo with fuel feed, plasma energy, and Ion-Layer current maintenance by fusion products; and (6) a natural divertor end loss of ashes with charge separation permitting a natural direct electrical conversion prospect.

6024 (CONF-821124—, pp 161-164) **Applications of accelerated compact toroids.** Hammer, J.H.; Hartman, C.W. (Lawrence Livermore National Lab., CA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450. Contract W-7405-ENG-48.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

It has recently been suggested that magnetic acceleration of low-β plasma rings, similar to those produced in existing experiments, could fill some of the wide gap in parameter space that lies between the extremes of conventional particle acceleration and magnetic acceleration of metallic slugs or magnetized pellets. Many applications can be conceived that exploit the newly-accessible regimes, some of which also make use of the special magnetic or confinement properties of the rings. Listed below are some of the possible applications, ordered in increasing energy (but not necessarily decreasing credibility). Low energy is defined as U = input energy ≅ U/sub M/ = initial magnetic energy. Medium energy is U > U/sub M/ and high energy is U >> U/sub M/.

6025 (CONF-821124—, pp 174-177) **Class of steady state compact tori.** Jensen, T.H.; Chu, M.S. (GA Technologies, Inc., San Diego, CA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

In the search for magnetic configurations for confinement of plasmas, it may be a prudent strategy to search in the neighborhood of absolutely stable (MHD-sense) configurations. Two classes of absolutely stable states are known, namely the vacuum field and the Taylor state. A configuration may also be classified according to its topology, singly or doubly connected. The singly connected configuration based on the vacuum field is the mirror while the double connected is the stellarator. The class of singly connected configurations based on Taylor states includes the spheromak and many yet unnamed configurations while that of doubly connected configurations includes tokamaks, RFP's and OHTE's. The class of configurations considered here is that of singly connected configurations based on Taylor states. The problem of steady current drive is particularly emphasized.

6026 **(CONF-8406153—2) Ion quadrupole effects in spectral line broadening.** Joyce, R.F.; Hooper, C.F. Jr. (Florida Univ., Gainesville (USA). Dept. of Physics). 1984. Contract AS08-81DP40159. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001504.

From 7. international conference on spectral line shapes; Aussois, France (11 Jun 1984).

Line broadening is currently being used as a diagnostic tool for density determination in dense plasmas. The applicability of this tool could be improved through better understanding of line shifts and asymmetries. Most calculable line shape theories to date employ the dipole approximation to treat the interaction between the radiator and perturbing ions. That is, the interaction is given by vector P.vector E, where vector P is the emitter dipole moment and vector E is a uniform quasistatic microfield due to the perturbing ions. It has been proposed that the next higher multipole in the radiator-perturbing ion interaction, that is the quadrupole-field gradient interaction, could be a significant source of asymmetry. In this paper we present a method to include the quadrupole interaction in line broadening theories and discuss some preliminary calculations.

6027 **(DOE/DP/40124—71) Coronal spectroscopy in laser plasmas.** Goldman, L.M.; Bahr, R.; Boni, R.; Boswell, B.; Craxton, R.S.; Delettrez, J.; McCrory, R.L.; Seka, W.; Short, R.W.; Tanaka, K. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 29 Oct 1984. Contract AC08-80DP40124. 12p. (CONF-841010—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002817.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

We present an overview of spectrally resolved electromagnetic emission from laser plasmas produced by irradiating solid targets at 351 nm and 1053 nm. The spectra are indicative of a large number of parametric processes occurring in the corona between 0.05n/sub c/ and n/sub c/. The data were taken in support of laser fusion experiments carried out at the Laboratory for Laser Energetics.

6028 **(DOE/DP/40159—1) X-ray broadening as a diagnostic in laser produced plasma. Annual report, 4 August 1981-3 August 1982.** Hooper, C.F. Jr. (Florida Univ., Gainesville (USA). Dept. of Physics). 1982. Contract AS08-81DP40159. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002989.

The theoretical line broadening research carried out under this contract involved three main areas: calculation of (1) widths, shifts, and asymmetries of Stark broadened Lyman series lines from high-Z hydrogenic radiators in dense plasmas, (2) spectral line opacity effects and satellite diagnostics, and (3) electric microfield distributions. The line broadening work included an extension of numerical techniques used a full coulomb calculation of broadening due to electron-radiator collisions, a preliminary full coulomb calculation of the line shift due to dynamic electron effects, and examination of the fine structure splitting and the quadratic Stark effect. A theoretical model is being developed as a density diagnostic for Lyman α and helium-like α satellite line ratios which are observed in current laser fusion experiments. An analysis of some simple microfield models currently employed in plasma calculations has also been done to determine their applicability. A simple independent particle model is shown to have a wide range of validity.

6029 **(DOE/ER/40091—T1) Colorado School of Mines Fusion Gamma Ray project. Annual progress report.** Cecil, F.E. (Colorado School of Mines, Golden (USA)). 1 Dec 1984. Contract AC02-83ER40091. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002637.

A characterization of the gamma ray detection properties of a 5" diameter x 5" high cell of the neutron insensitive liquid scintillator NE 226 was made. The past year has likewise seen a completion of the measurements of the gamma ray branching ratios of the DD, DT, and D^3He reactions at center of mass energies between 25 and 100 keV. In addition to these measured gamma ray ratios which were proposed in the original contract, we have completed a study of the ^6Li + d reactions at low energies as an example of the Oppenheimer-Phillips effect.

6030 **(DOE/ER/53140—16) Monte Carlo studies of tandem mirror plasmas interacting with waves in the ion cyclotron range of frequencies (ICRF). Progress report, July 1-September 30, 1984.** Todd, A.M.M. (Grumman Aerospace Corp., Princeton, NJ (USA)). Oct 1984. Contract AC02-82ER53140. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002988.

In this time period we have concentrated on the development of a wave propagation and antenna code for Tandem Mirrors which includes axial parameter variation. Initial results should be forthcoming at or shortly after the 1984 APS Meeting of the Division on Plasma Physics. Although the basic code has been written, there remain problems of boundary condition formulation. Our study of neutral beam deposition in PBX has been slowed by persistent problems that appear to be system related. We still hope to generate beam β information in time for the APS meeting.

6031 **(DOE/ET/52025—T3) Fusion Studies Program. Progress report.** Stacey, W.M. Jr. (Georgia Inst. of Tech., Atlanta (USA). School of Mechanical Engineering). 1984. Contract AS05-78ET52025. 42p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003072.

Continuation of work in two areas, impurity control and transient electromagnetics, is proposed. In the tokamak impurity control area, an innovative supplemental mechanism, NB-driven impurity flow reversal, has been developed partly under this contract; and the proposed effort is aimed at completing this development, verifying the methodology by comparison with experiment and evaluating its potential in future tokamak experiments. In the tokamak transient electromagnetics area, the proposed effort is aimed at developing a new and more efficient methodology for calculating the currents and resulting magnetic fields in the torus structure and coil systems, which will allow a detailed representation of the latter that can be coupled to the distributed-current plasma model that was implemented for vertical stability and disruption control studies in previous work under this contract; and the application of this methodology to study the control of vertical instabilities and disruptions.

6032 **(DOE/ET/53042—T1) Space-time statistics of the turbulence in a tokamak edge plasma.** Levinson, S.J.; Beall, J.M.; Powers, E.J. Jr.; Bengtson, R.D. (Texas Univ., Austin (USA). Center for Fusion Engineering). Jul 1984. Contract AS05-77ET53042. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002667.

Working paper No. 1.

The results of a study of the statistical space-time properties of the turbulence observed in the edge region of the PRETEXT Tokamak are reported. A local estimate of the wavenumber-frequency spectra S(k,ω) for poloidal (k/sub y/) and toroidal (k/sub z/) wavenumbers is determined for the range .5 $cm^{-1} < k < 7.5$ cm^{-1} for both potential and density fluctuations obtained from spatially fixed Langmuir probe pairs. The S(k/sub y/,ω) spectra are dominated by low frequencies (< 200 kHz) and small wavenumbers (< 3 cm^{-1}) and appear broadened about an approximately linear statistical dispersion relation, anti k(ω). The broadening is characterized by a spectral width σ/sub k/(ω) [rms deviation above anti k(ω)] which is of the order of anti k(ω). The turbulence appears to propagate poloidally with an apparent mean phase velocity of 1 to 2 x 10^5 cm/s in the ion diamagnetic drift direction. Measurements of the fluctuation-induced particle transport reveal the particle flux to be outward and resulting primarily from the low frequency, long wavelength components of the turbulence. A particle diffusion coefficient D/sub x/, estimated from measured particle flux and density profiles, is of the order of that estimated for Bohm diffusion, but appears to increase with density.

6033 **(DOE/ET/53088—156) Algebraic decay in self-similar Markov chains.** Hanson, J.D.; Cary, J.R.; Meiss, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Oct 1984. Contract FG05-80ET53088. 34p. (IFSR—156). NTIS, PC A03/MF A01; GPO Dep. File Number DE85003162.

A continuous time Markov chain is used to model motion in the neighborhood of a critical noble invariant circle in an area-preserving map. States in the infinite chain represent successive rational approximants to the frequency of the invariant circle. The nonlinear integral equation for the first passage time distribution is solved exactly. The asymptotic distribution is a power law times a function periodic in the logarithm of the time. For parameters relevant to Hamiltonian systems the decay proceeds as $t^{-4.05}$.

6034 **(IC—83/196) Some cnoidal wave solutions of some non-linear equations in one and two dimension.** Chowdhury, A.R.; Basak, S. (International Centre for Theoretical Physics, Trieste (Italy)). Oct 1983. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700052.

We have obtained, following Hirota's direct approach, some cnoidal wave solutions of some new non-linear equations in one and two dimensions. In the course of our calculation we have also extended the method for application to non-linear equations of higher order, where auxiliary independent variables are to be introduced for converting it into Hirota's framework. Lastly, solutions of some equations are obtained for which still now no inverse scattering is known to exist.

6035 **(IFTAR-FT—208-1982) Temperature-averaged Gaunt factor for bremsstrahlung energy production.** Vrejoiu, C.; Costescu, A.; Bogatu, N. (Institutul Central de Fizica, Bucharest (Romania)). Feb 1982. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700179.

This work presents some analytical and numerical results for temperature-averaged Gaunt factor in the case of a fully ionized maxwellian plasma. Comparison with exclusive numerical results existing in literature is made. Also, a very simple and accurate formula is proposed for practical use.

6036 **(IFTAR-LOP—22-1981) Two photon emission by hydrogen-like atoms in high temperature plasmas.** Costescu, A.; Manzatu, I.; Dinu, C.; Mihailescu, I.N. (Institutul Central de Fizica, Bucharest (Romania)). Aug 1981. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700154.

New exact solutions and a rather simple polynomial expression of the power emitted in the two photon transition from a metastable 2s state to the ground state of a hydrogen-like atom were infered with the aid of the Coulomb Green's function method. It was shown that the two photon decay represents under certain circumstances a significant power loss mechanism.

6037 **(IFTAR-LOP—27-1982) Study of the plasma focus ionic component.** Bocancea, A.; Mandache, N.B.; Zambreanu, V.I. (Institutul Central de Fizica, Bucharest (Romania)). May 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700156.

Experimental results on the energetic characteristics of the plasma focus ionic component, produced in the IPF 2/20 device are presented. For energies greater than approximate 50 keV the energy distributions of the ions emitted forward are well fitted by the exponential function exp(-E/B), where the medium value of B is 48 keV. Most of the distributions have a maximum in the energy range 25-47 keV.

6038 **(KFKI—1984-17) Giant sawtooth oscillation in ohmically heated tokamak plasma.** Montvai, A.; Tegze, M.; Valyi, L.; Zoletnik, S. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jan 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700051.

Submitted to Physical Letters A.

Strong, periodic instabilities were observed in the MT-1 tokamak. Characteristics of these instabilities were partly similar to those of internal disruptions, but there were features making them different from the normal relaxational oscillations. Basic characteristics of the phenomenon were studied with the aid of generally used diagnostics. 6 refs.; 8 figs.

6039 **(Rijnhuizen—84-151) Soft-X-ray electron temperature measurements on TORTUR.** Lopes Cardozo, N.J. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Feb 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700155.

During June and July 1982, some 250 discharges were produced in the TORTUR tokamak. The discharges can be characterized roughly by the predischarge current peak of 40 to 45 kA at 2 ms, followed by a current plateau of 30 to 40 kA which lasted 20 to 30 ms. At 5 ms, Thomson scattering indicated a central Tsub(e) of about 900 eV which fell to a lasting temperature of 600 to 400 eV in discharges that were stigmatized 'mildly turbulent' for their high ohmic dissipation. Soft-X-ray measurements of Tsub(e) were carried out with PLATO, a 4-channel X-ray detector, in which two surface barrier diodes and two channeltrons were mounted. Tsub(e) was determined by means of the absorber foil technique. To that end four exchangeable Be absorber foils ranging in thickness from 30 to 100 micron were mounted in each channel. Every single discharge yielded 3 independent, time-resolved (resolution 100 μs) measurements of Tsub(e).

6040 **(Rijnhuizen—84-152) Electrostatic drift modes in toroidal geometry.** Venema, M.; Schep, T.J. (Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica). Mar 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700157.

Toroidicity-induced drift modes are investigated in the collisionless regime. Ion magnetic drift resonant effects are fully retained, also in the ion sound contribution. It is shown that the modes with the least number of nodes between turning points are localized at the outside of the torus within the poloidal interval $(-\pi,\pi)$. Their amplitudes vanish before the magnetic drift resonance is actually reached. The lowest even mode becomes unstable due to the inverse Landau damping of circulating electrons. The non-adiabatic response of trapped electrons causes a decrease of the mode frequency. The maximum growth rate is determined at normal tokamak parameter values.

6041 **(RISO-M—2397) Thomson scattering system at DANTE.** Gadeberg, M. (Risoe National Lab., Roskilde (Denmark)). Aug 1983. 72p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85700050.

Subroutines and programs are listed in the appendices.

The construction and operation of the 90 deg Thomson Scattering diagnostic at DANTE is described. The system is based on a double-pulse ruby laser and a three channel spectrometer. Two single point measurements can be made during each plasma discharge.

6042 **(SAIC—84/1355/PRI-83) Ion streaming instabilities in thermal barrier.** Tsang, K.T. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Sep 1984. Contract AC03-76ET53057. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002659.

The ion distribution function in a thermal barrier is modeled by counter streaming Maxwellian distribution. Its stability with respect to parallel propagating electrostatic and electromagnetic modes is investigated both analytically and numerically. It is found that the electrostatic mode is stable if T/sub e//T/sub i/ $\geq$ 3.5 and the electromagnetic mode is stable if the streaming velocity is less than the Alfven speed. The latter condition implies the barrier potential must be less than the average magnetic energy per particle.

6043 **(SAIC—84/1787/PRI-84) Entropy production determination of the ambipolar solution nearest equilibrium.** Catto, P.J.; Myra, J.R. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Oct 1984. Contract AC03-76ET53057. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85003049.

A general derivation of the steady state entropy production equation is presented for a confined plasma which loses particles and energy via radial transport and, perhaps, end loss. The resulting equation is employed to determine which root or solution is closest to thermodynamic equilibrium when more than one self-consistent or ambipolar solution is possible.

6044 **Direct observation of the structure of global Alfven eigenmodes in a tokamak plasma.** Evans, T.E.; Valanju, P.M.; Benesch, J.F.; Bengtson, R.D.; Li, Y.; Mahajan, S.M.; Oakes, M.E.; Ross, D.W.; Wang, X.; Watkins, J.G. (University of Texas at Austin, Austin, Texas 78712). *Physical Review Letters;* **53**: No. 18, 1743-1746(29 Oct 1984).

We present the first direct observation of the structure of a driven global Alfven eigenmode in a tokamak plasma using CO_2 laser interferometry.

6045 **Observation of the Rayleigh-Taylor instability in ablatively accelerated foils.** Grun, J.; Emery, M.H.; Kacenjar, S.; Opal, C.B.; McLean, E.A.; Obenschain, S.P.; Ripin, B.H.; Schmitt, A. (Naval Research Laboratory, Washington, DC 20375). *Physical Review Letters;* **53**: No. 14, 1352-1355(1 Oct 1984).

We present the first absolute, two-dimensionally resolved measurements of areal mass density of laser-driven ablatively accelerated foils, which show the Rayleigh-Taylor instability developing from initial mass perturbations. Our data are near simulation results which predict that the Rayleigh-Taylor growth rate is less than classical. The measurements sometimes show development of significant areal mass inhomogeneity in a direction perpendicular to that of the initially imposed perturbations.

6046 **High-power electron Landau-heating experiments in the lower hybrid frequency range in a tokamak plasma.** Porkolab, M.; Lloyd, B.; Takase, Y.; Bonoli, P.; Fiore, C.; Gandy, R.; Granetz, R.; Griffin, D.; Gwinn, D.; Lipscultz, B. (Massachusetts Institute of Technology, Plasma Fusion Center, Cambridge, Massachusetts 02139). *Physical Review Letters;* **53**: No. 13, 1229-1232(24 Sep 1984). Contract AC02-78ET51013.

The effectiveness of plasma heating by electron Landau interaction in the lower hybrid range of frequencies in tokamak plasmas is demonstrated. Upon injection of 850 kW of rf power at a density of n-barsube$\simeq$1.4 x 10sup14 cmsup-3, an electron temperature increase of 1.0 keV and an ion temperature increase of 0.8 keV was achieved. These results are compared with transport and ray-tracing code predictions.

6047 **Magnetic instabilities in accelerating plasma surfaces.** Amendt, P.; Rahman, H.U.; Strauss, M. (Physics Department, University of California, Irvine, California 92717). *Physical Review Letters;* **53**: No. 13, 1226-1228(24 Sep 1984). Contract AC04-76DP00789.

The existence of an interchange instability strictly associated with electron inertia is demonstrated. This is characterized by a

growth rate significantly larger than the usual ion-inertial Rayleigh-Taylor rate and by self-generated magnetic fields localized around the accelerating plasma surface. This novel instability may be partially responsible for the observed magnetic fields in ablatively accelerated laser plasmas.

6048 **Collective enhancement of radial transport in a nonneutral plasma.** Eggleston, D.L.; O'Neil, T.M.; Malmberg, J.H. (Department of Physics, University of California San Diego, La Jolla, California 92093). *Physical Review Letters;* **53**: No. 10, 982-984(3 Sep 1984).

Experimental evidence is presented showing that collective effects may enhance the radial transport produced by an asymmetric perturbing field applied to a rotating nonneutral plasma column. The field asymmetry drives an asymmetric plasma mode and the mode field produces additional transport. Of particular interest for confinement systems is the existence of a zero-frequency plasma mode which can be driven by static field asymmetries. Applications to tandem mirrors are discussed.

6049 **Ground configuration of the phosphorus sequnce from copper to molybdenum.** Denne, B.; Hinnov, E.; Suckewer, S.; Timberlake, J. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08544). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 2, 296-299(Apr 1984).

The energy-level structure of the $3s^23p^3$ configuration of the phosphorus sequnce ions Mo XXVIII and Zr XXVI has been determined from magnetic-dipole line wavelengths and emissivities measured in the Princeton Large Torus tokamak discharges. The new measurements have caused some changes in the tentative assignments reported earlier for this sequence, especially for the ^{4}S/sub 3/2/—^{2}D/sub 3/2/ transitions. Isoelectronic interpolations together with some experimental confirmations in the Se XX and Ge XVIII spectra now permit a reasonably accurate and complete reconstuction of this configuration from Z = 42 to previously established Z< or =28 elements. The measured wavelengths and relative intensities are in substantial agreement with recent semiempirical evaluations and ab initio calculations.

6050 **Shifts of spectral lines in a plasma.** Iglesias, C.A. (Rutgers Univ., New Brunswick, NJ). *Physical Review [Section] B: Solid State;* **29**: 1366-1370(Mar 1984). Contract W-7405-ENG-48.

The theory of spectral lines in a plasma with quasistatic ions is reconsidered. The ion microfield distribution, generalized to include field gradients and higher-order derivatives, is introduced without decoupling the ion and electron subsystems. It is shown that in a self-consistent treatment of ion-electron correlations the calculations of line shifts requires a more complete theory than has been used in the past. It is shown that level shifts due to a time average of the radiator-plasma interaction are closely related to shifts due to ion field inhomogeneities at the radiator. These two shifting mechanisms are not independent and the analysis indicates how to avoid overcounting. As a result, the time average of the radiator-plasma interaction, usually associated with the so-called plasma polarization shift, is formally different from the equivalent expression given by theories which treat electron-ion correlations in an ad hoc fashion. 14 references.

6051 **Improvement of the two-temperature radiative transport model.** McCarville, T.J.; Bohachevsky, I.O.; Kulcinski, G.L.; Moses, G.A. (TRW Energy Dev. Group, Redondo Beach, CA). *Nuclear Technology/Fusion;* **5**: No. 1, 5-16(Jan 1984).

The frequency dependence of a thermal radiation field complicates the computation of radiative energy transport in optically thin media because the spectrum may be uncoupled from local thermodynamic conditions. A model for combining the effect of the frequency dependence into a radiation temperature chosen to represent the temperature of both local and nonlocal emitting regions is described. The derived equations are much easier to solve than the frequencydependent equations and can be applied to a broad class of problems. The equations are used to investigate the response of a gas in an inertial confinement fusion (ICF) reaction chamber to target explosions. The response is compared for ambient densities of 1.77×10^{16} and 1.77×10^{17} atom/cm^3. The error in using the brightness temperature instead of a color temperature to evaluate the opacities is illustrated. An analytic analysis shows the cooling wave observed from energy releases $> 10^{18}$ erg will not occur in an ICF cavity. This is confirmed by the numerical calculations.

6052 **A nuclear diagnostic for fast alpha particles.** Grisham, L.R.; Dawson, J.M.; Post, D.E. (Princeton University Plasma Physics Laboratory, Princeton, New Jersey). *Nuclear Technology/Fusion;* **4**: No. 3, 452-455(Nov 1983).

The authors investigate the possibility of seeding a fusion plasma with nuclei that can undergo nuclear reactions with energetic alpha particles to produce product nuclei that are radioactive. If a fraction of these product nuclei can be collected and measured, one can obtain information about the presence of fast alpha particles. It appears that a feasible diagnostic could be based on the ^{10}B(α,n) ^{13}N reaction.

6053 **Electron transport in one-dimensional plasmas.** Wienke, B.R. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Technology/Fusion;* **4**: No. 3, 426-436(Nov 1983).

A one-dimensional, multigroup, discrete ordinates technique for computing electron energy deposition in plasmas is detailed. The Fokker-Planck collision operator is employed in the continuous approximation and electric fields (considered external) are included in the equation. Bremsstrahlung processes are not treated. Comparisons with analytic and Monte Carlo results are given. Fits to deposition profiles and energy scaling are proposed and discussed for monoenergetic and Maxwellian sources in the range, 0 to 150 keV, with and without uniform fields. The techniques employed to track electrons are generally useful in situations where the background plasma temperature is an order of magnitude smaller than the electron energy and collective plasma effects are negligible. We have used the approach successfully in laser pellet implosion applications.

6054 **Effects of enhanced ion/electron equilibration power on Cat-D tokamak ignition.** Galambos, J.; Miley, G.H. (Univ. of Illinois, Fusion Studies Lab., 103 S. Goodwin Avenue, Urbana, IL 61801). *Nuclear Technology/Fusion;* **4**: No. 2, 241-245(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The ion to electron temperature ratio (T /SUB i/ /T /SUB e/) is a crucial parameter that affects fusion plasma performance, especially for higher temperature advanced fuel operation. An important factor in the determination of T /SUB i/ /T /SUB e/ is the equilibration of energy between ions and electrons. The effect of changes on equilibration rates due to the presence of a magnetic field are considered here. It is found that rates are increased for low beta (about 10%) high temperatures (about 75 keV) Cat-D plasmas, causing a decrease in T /SUB i/ /T /SUB e/ and a corresponding increase in n/tau/ /SUB E/ for ignition of about 75%. This effect is less pronounced for high-beta plasmas. Scaling of the changes in equilibration power with macroscopic quantities are presented.

6055 **Assessment of energetic ion rings versus electron rings for an EBT reactor.** McBride, J.B.; Uckan, N.A. (Science Applications, Inc., La Jolla, CA 92038). *Nuclear Technology/Fusion;* **4**: No. 2, 497-501(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

This paper summarizes the results of a preliminary assessment of energetic ion rings for use in an ELMO Bumpy Torus (EBT) reactor. The properties of ion rings are compared with those of electron rings. Ion rings appear to require sizable devices and magnetic field strengths for stable, adiabatic confinement. Stable windows for steady-state ion ring operation having acceptable power requirements, determined mainly by Coulomb drag on the background electrons, appear to exist for EBT reactors. Power requirements for ion rings can be quantitatively lower than those for electron rings, provided the ion ring volume does not greatly

exceed the electron ring volume. Some stability properties of ion rings are also discussed. Results of parametric trade-off studies for ion rings versus electron rings using an EBT reactor systems code are presented.

6056 **Analysis of alpha particle behavior in EBT reactor.** Fenstermacher, M.E.; Uckan, N.A. (Univ. of Michigan, Ann Arbor, MI 48109). *Nuclear Technology/Fusion;* 4: No. 2, 502-506(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A formalism has been developed in terms of a drift kinetic equation with a Fokker-Planck collision operator to calculate alpha particle loss and energy deposition rate coefficients for one position in space and for steady-state operating conditions in an ELMO Bumpy Torus (EBT) reactor. Pitch angle and energy scattering terms were retained in the collision term so that the analysis provides information on alpha particle behavior due to pitch angle scattering into loss regions in velocity space and information on alpha energy deposition during slowing down in the device. A square well magnetic field shape is assumed and the resulting particle loss rates and energy deposition rates are calculated. For typical EBT reactor parameters, results show that while 80-90% of the alpha particles are scattered into a pitch angle loss region and lost from the device, more than 70% of the alpha particle energy is deposited in the core plasma and about 1-2% goes to alphas retained in the plasma as ash. Parametric studies are performed, and the sensitivity to plasma potential, the pitch angle, the width of loss regions, and computational procedures are analyzed.

6057 **A technique for measuring the fast $^3He^{++}$ distribution during $^3He^{++}$ minority ICRF heating.** Post, D.E.; Grisham, L.R.; Medley, S.S. (Princeton Plasma Physics Laboratory, Princeton, New Jersey). *Nuclear Technology/Fusion;* 3: No. 3, 457-461(May 1983).

A technique for measuring the fast $^3He^{++}$ distribution during $^3He^{++}$ minority ion cyclotron resonance frequency heating is discussed. The technique involves the use of 10- to 100-keV neutral helium beams to neutralize the fast $^3He^{++}$ ions by double charge-exchange ($^3He^{++} + {}^4He^0 \rightarrow {}^3He^0 + {}^4He^{++}$). The neutralized fast ^3He atoms then escape from the plasma and are detected by conventional neutral particle analyzing apparatuses. By the use of such a technique, the effectiveness of the coupling of the ion cyclotron waves to the $^3He^{++}$ minority can be measured.

6058 **Toroidal research-status and prospects.** Furth, H.P. (Princeton Plasma Physics Laboratory, Princeton, NJ). pp 15-16 of Fusion engineering. Vol. 1. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

During the past two years, toroidal confinement experiments have achieved great advances. Effective new techniques have been developed in several areas of plasma engineering, and all principal plasma parameters (n, T, /TAU/ /SUB E/ , n/TAU/ /SUB E/ , β) are now coming closer to reactor requirements. The present review focuses mainly on the contribution to this world-wide progress made by the U.S. tokamak program. Initial Alcator C experiments with gas-puffing were characterized by the increase of confinement time with plasma density, but saturation at high densities. The more recent use of pellet injection techniques (developed for ISX at ORNL) has helped to avoid saturation, thus leading to the achievement of record levels of the Lawson parameter n/ TAU/ /SUB E/ . The location of the most advanced present-day experimental point in the Lawson diagram is illustrated.

6059 **Fusion engineering. Vol. 2.** Young, N.E.; Pinter, G.R.; Spinos, F.R. (Ebasco Services Incorporated, Princeton, NJ 08544). pp 1560-1564 of 10. symposium on fusion engineering. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

An x-ray crystal spectrometer is scheduled for installation in the Tokamak Fusion Test Reactor in 1984 coinciding with the TFTR deuterium operation phase. This spectrometer is designed to measure the spectra of hydrogen-like and helium-like impurities in the plasma. Ion temperatures electron temperatures, electron density and the distribution of impurity charge states are obtained from the x-ray detector count ratios. The velocity of the toroidal rotation of the plasma is also discerned using this device. The x-ray crystal spectrometer is based on the Bragg diffraction of x-rays from a curved crystal impinging on a multiwire proportional counter. Only those x-rays that satisfy the Bragg relationship ($\lambda = 2d \sin \theta$) will be diffracted and strike the proportional counter. This paper is limited to a discussion of the physical characteristics of the spectrometer and the methods devised to satisfy the operational aspects of such a device.

6060 **4P2 TFTR TV thomson scattering.** Leftheris, B.; Dimock, D.; Tolnas, E. (Princeton Univ., Plasma Physics Laboratory, Princeton, NJ). pp 1582-1594 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Temperatures and densities of TFTR plasmas are measured through the light scattering of two ruby laser beams that are pulsed through the plasma. This TFTR device is designed to record simultaneously the plasma conditions at 76 points along the minor diameter of the torus for each laser beam. A concentric optical system, originally suggested by A. Bouwers is used to gather the scattered light and direct it through 10-m-long fiber optics to the spectrometer which is located in the basement. This paper describes the mechanical design of the system and the engineering analysis of interaction between the high magnetic fields and the structure that allows the placement and removal of the optical system from the basement ceiling.

6061 **Expeditious Vlasov solver for computation of ion extraction from a plasma.** Whealton, J.H. (Oak Ridge National Lab., TN). *Journal of Computational Physics;* 40: No. 2, 491-496(Apr 1981). Contract AC05-84OR21400.

An algorithm has been developed and previously reported that is applicable for the design of accelerating structures for intense neutral beam injectors for fusion research. The computional speed of the algorithm has not been satisfactory, and an alternative Vlasov solver and Poisson-Vlasov iteration scheme which increases the expeditiousness of the computation are described. A case is considered in which the electric field is considered a constant from which it follows that the ion trajectory is a parabole, and a flow diagram is shown. Using a simultaneous iteration scheme where the Vlasov iteration is made prior to convergence of the Poisson equation, a decrease in computational time of the Poisson solver of a factor of 8 was obtained without any loss of accuracy; and for a particular case, an overall gain of 12 in increase in computational speed was actually achieved. (BLM)

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6062 **(AAEC/E—583) Extension of the AUS reactor neutronics system for application to fusion blanket neutronics.** Robinson, G.S. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85700049.

The AUS modular code scheme for reactor neutronics computations has been extended to apply to fusion blanket neutronics. A new group cross-section library with 200 neutron groups, 37 photon groups and kerma factor data has been generated from ENDF/B-IV. The library includes neutron resonance subgroup parameters and temperature-dependent data for thermal neutron scattering matrices. The validity of the overall calculation system for fusion applications has been checked by comparison with a number of published conceptual design studies.

6063 (CONF-821124—) **Fifth symposium on the physics and technology of compact toroids: proceedings.** Hoffman, A.L.; Milroy, R.D. (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Jan 1983. Contract AC06-80ER53096. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Separate abstracts were prepared for 25 of the 39 included papers. Abstracts for the remaining 14 papers appeared previously in ERA. (MOW)

6064 (CONF-821124—, pp 8-11) **Flux trapping during field reversal in a field reversed theta pinch.** Milroy, R.D.; Hoffman, A.L.; Slough, J.T.; Harding, D.G. (Mathematical Sciences Northwest, Inc. Bellevue, WA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

In this paper we present new results from both numerical and experimental studies of the formation of the conducting sheath near the tube wall and its effectiveness in trapping bias flux during field reversal.

6065 (CONF-821124—, pp 16-21) **Generation of field-reversed-configurations with high bias flux using controlled reconnection.** Slough, J.T.; Harding, D.G.; Hoffman, A.L. (Mathematical Sciences Northwest Inc., Bellevue, WA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The magnitude of poloidal flux and the ultimate size of field-reversed-configurations formed in field-reversed-theta-pinches depends on the amount of initial bias flux which can be trapped. Operation at high bias fluxes results in violent axial contractions and severe flux loss, thus preventing the attainment of high poloidal flux toroids. The use of controlled reconnection techniques permits stable generation at higher bias fluxes, and thus the generation of more energetic field-reversed-configurations.

6066 (CONF-821124—, pp 27-30) **Merging spheromaks produced by the conical theta pinch machine.** Kawai, K.; Pietrzyk, Z.A.; Brooks, R.D. (Univ. of Washington, Seattle). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The experimental setup, which consists of two identical conical theta pinches facing each other, is shown. The pinches produce spheromaks moving with a velocity of 3 to 5 cm/μs. Though the current in the pinches is not crowbarred, the magnetic field on axis within the merged spheromaks lies in one direction. The fill pressure for stable operation can be varied from 5-200 mT. Diagnostics include: internal magnetic probes, diamagnetic probes, spectroscopy, Thomson scattering and visual photography.

6067 (CONF-821124—, pp 39-45) **Status of fabrication of the S-1 Spheromak device.** Ellis, R. Jr.; Janos, A.; Joyce, J.; Yamada, M. (Princeton Univ., NJ). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450. Contract AC02-76CH03073.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The S-1 Spheromak is nearing completion and the first plasma operation is scheduled for March, 1983. The design started in 1980. A budget adjustment forced postponement of completion from December 1982 to August 1983. The quasistatic inductive transfer of flux has been tested in prototype devices at the Princeton University Plasma Physics Laboratory. This method of producing a spheromak employs poloidal (PF) and toroidal (TF) windings in a flux core first to produce a plasma surrounding the flux core that subsequently forms a spheromak by a reconnection process. The equilibrium is maintained by a steady field (EF) supplied by a coil system that is mounted on the vacuum vessel. The state of construction of the principal elements of the S-1 device are described.

6068 (CONF-821124—, pp 46-49) **Spheromak formation with divertors.** Sun, Y.C.; Jardin, S.C.; Yamada, M. (Princeton Univ., NJ). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450. Contract AC02-76CH03073.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The tool we used for this investigation is a previously reported simulation code. It is a one fluid, two-dimensional, resistive MHD code with coupled circuit equations to compute the inductive transfer of current from the poloidal and toroidal coils to the plasma. A coronal non-equilibrium atomic physics model is used to compute the impurity radiation losses. We have added internal divertor coils to the code for our present study.

6069 (CONF-821124—, pp 92-95) **Comments on steady-state equilibrium profiles in field-reversed configurations.** Terry, W.K. (Purdue Univ., Lafayette, IN). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450. Contract AC02-79ER10044.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

This paper presents conclusions about the character of equilibrium profiles which may be sustained in steady state in a highly elongated (long-thin) Field-Reversed Configuration (FRC). It is shown in this paper that equilibria which can be sustained in a steady state in a long-thin FRC obeying classical diffusion are likely to involve relatively high fluid pressure outside the separatrix - a condition which also leads to rapid particle losses along the open field lines. Thus, suppression of microinstabilities may not actually result in better particle confinement.

6070 (CONF-821124—, pp 122-127) **Experimental investigation of spheromak configurations in Proto S-1C.** Paul, S.; Janos, A.; McNeill, D.; Newhouse, M.; Yamada, M. (Princeton Univ., NJ). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The Proto S-1C device was constructed to investigate further the electrodeless, quasi-static scheme for forming a spheromak. A double-sized version of the previous spheromak experiment at PPPL, the primary purpose of Proto S-1C is the achievement of higher temperatures and longer lifetimes, and the study of equilibrium and stability aspects of the larger configuration. The Proto S-1C flux core is a combination of toroidal and poloidal field windings enclosed in a toroidally shaped support having a major radius of 30 cm and a minor radius of 6 cm. The core is lined with 5 mil thick stainless steel sheet, which is formed and welded to provide a vacuum seal. The toroidal and poloidal fields are generated by 72 kG and 24 kJ capacitor banks, respectively. The rise time of the TF bank, which defines the spheromak formation time is 50 μsec. The resulting poloidal and toroidal plasma currents are 120 and 60 kA, respectively. The equilibrium field is provided in part by a steady-state field, produced by coils outside the vacuum vessel. An EF current of 1800 amp generates a mirror-like field with a strength of 2 kG. Reconnection occurs upon reversal of the poloidal field, and the plasma is pinched off the core and moved into the center of the vacuum vessel. The strength and crowbar time of the poloidal field bank determine the extent to which the plasma separates from the core and, therefore, strongly affect the stability.

6071 (CONF-821124—, pp 139-142) **Pulsed diode source of polarized ions.** Katzenstein, J.; Rostoker, N. (Univ. of California, Irvine). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

The advantages of polarized nuclei for fusion reactors have recently been described. We propose a pulsed source of polarized nuclei that consists of an ion diode with a polarized anode. With magnetic resonance techniques the nuclear spins of the protons of solid NH_3 can be made about 90 to 95% polarized. This material would be used for the anode. The diode would be pulsed with a voltage of 1-200K-volts for 1-2 μ sec. Flashover of the anode produces a surface plasma from which the polarized protons would be extracted to form a beam. Depolarization could be detected by comparing reaction cross sections and/or distribution of reaction products with similar results for unpolarized beams.

6072 (CONF-821124—, pp 143-146) **Cusp injection of a 700 ns rotating REB into a preformed plasma.** Saenz, G.A. (Univ. of California, Irvine). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Computer calculations indicate that in a mirror geometry with an axial current to generate a B/sub θ/, single particles trajectories change radius as the z component of velocity changes magnitude and direction. The axisymmetric orbit can be solved analytically. This analysis may lead to new methods of trapping e-layers in a preformed plasma.

6073 (CONF-821124—, pp 147-151) **Recent results of the RECE-Christa experiment.** Taggart, D.; Parker, M.; Hopman, H.; Jayakumar, R.; Fleischmann, H.H. (Cornell Univ., Ithaca, NY). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

This paper is primarily a description of recent experimental studies in the RECE-Christa device on the dynamics and stability characteristics of mixed-CT configurations which are generated by inducing sizable plasma ring currents in field-reversing E-layers. Other potential CT configurations, in particular the Spheromak-type, have been projected theoretically and also observed experimentally to have a strong tendency towards tilt-instability except under certain circumstances which would tend to exclude potentially very interesting reactor designs. Based on the fact that this instability has never been observed in field-reversing large-orbit electron ring experiments (probably due to coupling through the large-orbit particles between the tilt motion and the internal length parameters of the rings), it has been suggested (4) that this problem may be avoided by adding large-orbit particles carrying some of the ring current to the normal Spheromak configuration. Also, recent theoretical analyses using the angular momentum of the fact particles indicate a stabilizing tendency, although we believe this mechanism is resistively unstable. The present experiments are the first to test this situation, with the results indicating good gross stability even in cases with large plasma currents. In addition we report the generation of highly elongated E-layers and preliminary results of trapping experiments in low toroidal (B/sub θ/) fields.

6074 (CONF-821124—, pp 152-156) **Compact toroid generated with two counterstreaming electron beams.** Sethian, J.D.; Gerber, K.A.; DeSilva, A.W.; Robson, A.E. (Naval Research Lab., Washington, DC). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

It is shown that a Compact Toroid can be made by a novel method using two rotating relativistic electron beams. The beams are sequentially injected into an initially field-free metal tube filled with neutral hydrogen. By adjusting the gas pressure so the plasma produced by the first beam is sufficient to neutralize the beam charge, but not the beam current, the first beam can be made to induce the fields, heat the plasma, thus freezing in the fields and, upon leaving the system, induce persistent plasma currents that maintain the field configuration established during the beam pulse. This configuration has two components: (1) a reversed B/sub z/ field (because the net axial flux through the tube must always be zero, the axial field induced the plasma has a corresponding antiparallel component between the plasma and wall), and (2) and external B/sub θ/ field. The latter is maintained by a continuous net axial current that returns through the walls. The configuration produced by the first beam is thus a linear reversed field pinch.

6075 (CONF-821124—, pp 157-160) **Reactor scenarios for compact toroids.** Hagenson, R.L. (Technology International Inc., Ames, Iowa). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

A comparison of key parameters of 8 different compact tori was made. The data are given in tabular form. (MOW)

6076 (CONF-821124—, pp 178-184) **Comparison of Spheromaks and FRCs.** Vlases, G.C. (Mathematical Sciences Northwest, Inc., Bellevue, WA). Jan 1983. NTIS, PC A09/MF A01. File Number TI85000450.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Bellevue, WA, USA (16 Nov 1982).

Within the past year there have been dramatic advances in both the Spheromak and FRC branches of the Compact Toroid (CT) research program. The long-troublesome n=2 rotational instability has been controlled in FRC experiments at Osaka University and MSNW, while improved impurity control techniques have lead to the extension of spheromak configurational lifetimes to the 1 ms range at LANL and Osaka. It thus seems appropriate, on the occasion of this 5th CT Symposium, to compare the two approaches with respect to present status and potential for extrapolation to reactors and critical research needs.

6077 (CONF-831203—187) **Design, fabrication, and testing of the pulse coils for the Large Coil Test Facility.** Chipley, K.K.; Parrelli, A.P. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.; Magnetic Corp. of America, Waltham, MA). 1983. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002569.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Large Coil Test Facility (LCTF) will be able to test up to six large superconducting coils similar to those required for a tokamak reactor. In order to simulate the transient vertical field that will be part of the magnetic environment of an operating tokamak reactor, a set of pulse coils will be used in the facility. This set of two coils can be positioned in the bore of any of the test coils to provide a transient magnetic field to that particular coil. This paper describes the final design of the pulse coils and discusses the fabrication techniques used to build these coils. An extensive testing program has been carried out during fabrication to ensure that the coils will function satisfactorily.

6078 (CONF-831203—188) **Assembly and installation of the large coil test facility test stand.** Queen, C.C. Jr. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 1983. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002573.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Large Coil Test Facility (LCTF) was built to test six tokamak-type superconducting coils, with three to be designed and built by US industrial teams and three provided by Japan, Switzerland, and Euratom under an international agreement. The facility is designed to test these coils in an environment which simulates that of a tokamak. The heart of this facility is the test stand, which is made up of four major assemblies: the Gravity Base Assembly, the Bucking Post Assembly, the Torque Ring Assembly, and the Pulse Coil Assembly. This paper provides a detailed review of the assembly and installation of the test stand components and the handling and installation of the first coil into the test stand.

6079 **(CONF-831203—190) Design description of the Advanced Toroidal Facility.** Nelson, B.E.; Cain, W.D.; Chipley, K.K.; Cole, M.J.; Forseman, J.W.; Jernigan, T.C.; Johnson, R.L.; Monday, J.F.; Thompson, P.B.; Vinyard, L.M.; Williamson, D.E. (Oak Ridge National Lab., TN (USA)). Dec 1983. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002558.

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Advanced Toroidal Facility (ATF) is a large torsatron being designed at Oak Ridge National Laboratory (ORNL) to replace the Impurity Study Experiment (ISX-B) tokamak. ATF will have a major radius of 2.1 m and an average plasma minor radius of 0.3 m. Major components of the device include the coil sets, structure, and vacuum vessel. The coil sets are designed for broad operating envelopes, including the capability to drive up to 100 kA of plasma current, to produce helical axis configurations, and to operate continuously at one-half the baseline currents. The ATF structure consists of a 40-mm-thick stainless steel toroidal shell encasing the helical coil set. The shell is constructed from 24 identical upper and lower segments, with 12 pairs of intermediate panels to provide access to the helical field (HF) coil joints. The lower portion of the shell also serves as an assembly fixture for the HF coil set. The vacuum vessel is a highly contoured 6-mm-thick stainless steel shell closely fitting the bore and sidewalls of the HF coil winding to provide maximum volume for the plasma. Forty-eight large ports allow good access for diagnostics and neutral beam injection.

6080 **(CONF-840915—9) All solid state high voltage power supply for neutral beam sources.** Praeg, W.F. (Argonne National Lab., IL (USA)). 14 Sep 1984. Contract W-31-109-ENG-38. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002531.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

The conceptual design of a high frequency solid state, high power, high voltage, power system that reacts fast enough to be compatible with the requirements of a neutral beam source is presented. The system offers the potential of significant advantages over conventional power line frequency systems; such as high reliability, long life, relatively little maintenance requirements, compact size and modular design.

6081 **(CONF-840937—16) EBT-P Magnet Development Program summary.** McManamy, T.J.; Lue, J.W.; Ballou, J.K.; Mann, T.L.; Shen, S.S.; Wilson, C.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002486.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

The ELMO Bumpy Torus Proof-of-Principle Magnet Development Program, which began in 1979, has fabricated and tested three NbTi superconducting magnets. The magnets are metastable with a maximum winding pack current density of 10,000 A/cm^2 at a peak field of 7.4 T. Each magnet has been installed in a closefitting dewar with a warm bore. Previous publications have reported successful tests of the first two windings in a large dewar, tests of the first complete magnet in its own dewar, and construction details of the dewars. This paper gives procedures and results for the test of the third winding in an open dewar, the test of the second single magnet in its own dewar, and two tests in which two magnets were run in series to generate a 73,000-lb side load at 5 T. The last tests verified the mechanical integrity of the design and qualified two of the magnets for use in the National Radio Frequency Test Facility.

6082 **(CONF-841246—5) Thermodynamics of Li_2O and other breeders for fusion reactors.** Fischer, A.K.; Johnson, C.E. (Argonne National Lab., IL (USA)). 3 Dec 1984. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001817.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

Thermodynamic calculations have been made to compare the thermochemical performance of the fusion reactor breeder blanket materials, Li_2O, $LiAlO_2$, and Li_4SiO_4 in the temperature range 900 to 1300K and in the oxygen activity range 10^{-25} to 10^{-5}. In general, $LiAlO_2$ offers advantages over Li_2O, and Li_2O in turn appears better than Li_4SiO_4. The protium purge technique of enhancing tritium release is explored for the $LiAlO_2$ system. Oxygen activity is an influential variable in these systems and must be considered in executing and interpreting measurements on rates of tritium release, the chemical form of the released tritium, diffusion of tritiated species and their identities, retention of tritium in the condensed phase, and solubility of hydrogen isotope gases. Surface adsorption is seen as a potentially significant contributor to tritium inventory.

6083 **(DOE/DP/40124—47) Irradiation uniformity of spherical targets by multiple uv beams from OMEGA.** Beich, W.; Dunn, M.; Hutchison, R.; Lampeter, W.; Kessler, T.; Richardson, M.C.; Seka, W.; Skupsky, S.; Soures, J.; Tomer, S. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 22p. (CONF-841010—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002820.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

Direct-drive laser fusion demands extremely high levels of irradiation uniformity to ensure uniform compression of spherical targets. The assessment of illumination uniformity of targets irradiated by multiple beams from the OMEGA facility is made with the aid of multiple beams spherical superposition codes, which take into account ray tracing and absorption and a detailed knowledge of the intensity distribution of each beam in the target plane. In this report, recent estimates of the irradiation uniformity achieved with 6 and 12 uv beams of OMEGA will be compared with previous measurements in the IR, and predictions will be made for the uv illumination uniformity achievable with 24 beams of OMEGA.

6084 **(DOE/DP/40124—48) Hydrodynamic efficiency and thermal transport in planar target experiments at LLE.** Boehly, T.; Goldman, L.M.; Seka, W.; Craxton, R.S. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 16p. (CONF-841010—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002821.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

The authors report the results of single beam irradiation of thin CH foils at laser intensities of 10^{13} to 10^{15} W/cm^2 in 0.8 ns pulses containing 20 to 50 J of 350 nm and 1054 nm light. They also discuss the hydrodynamic efficiency, thermal transport and preheat in these targets. Included is the measurement of the ion blowoff energy distribution and velocity. The efficient acceleration by short wavelength radiation causes target displacements comparable to the spot size resulting in two-dimension effects. The results are adequately modeled with the 2-D hydrocode SAGE using a flux limiter of f=0.04.

6085 **(DOE/DP/40124—49) Ion velocity distributions from spherical 1054 nm and 351 nm laser plasmas.** Boswell, B.; Boehly, T.; Delettrez, J.; Goldman, L.M.; Richardson, M.C.; Sarraf, S. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 31p. (CONF-841010—3). NTIS, PC A03/MF A01; GPO Dep. File Number DE85002816.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

We report the observation of ion velocity distributions from spherically illuminated targets, and compare the results to the predictions of analytical ablation models and the 1-D hydrodynamic code LILAC. Low-Z spherical targets were irradiated at 351 nm and 1054 nm by the OMEGA laser system at intensities $\leqq 10^{15}$ W/cm^2. The uv pulses were from 6 and 12 beams, 600 ps duration, and the ir from 24 beams, 1 ns duration. Velocity distributions were taken with Faraday cups and a Thomson parabola. Peak velocities for uv show agreement with the exhaust velocities predicted by the spherical steady-state ablation model, and agree in shape with LILAC simulations, while ir velocity distributions are more characteristic of isothermal expansion.

6086 **(DOE/DP/40124—51) Absorption spectroscopy as a density diagnostic for dense imploded shells.** Epstein, R.; Skupsky, S.; Yaakobi, B. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 13p. (CONF-841010—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002813.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

Absorption lines of tamper-layer additives may serve as diagnostics of the shell areal density (rho R) and thus of the core compression in high-compression target implosion experiments. The range of implosion conditions for which this technique would be applicable is investigated. Non-LTE simulations of absorption spectra are presented to illustrate cases of interest.

6087 **(DOE/DP/40124—54) Nonlinear saturation of stimulated Raman scattering in collisional homogeneous plasma.** McKinstrie, C.J.; Simon, A. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 23p. (CONF-841010—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002814.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

Using multiple time scale analysis we have extended a previous threshold calculation of nonlinear saturation of the SRS instability in collisional homogeneous plasma. This purely temporal problem, with a ubiquitous driver and arbitrary damping for each wave, is solved for incident pump amplitudes exceeding threshold by the factor m (where m can be much larger than unity). We obtain new expressions for the saturated amplitude of each wave and demonstrate that the nonlinear frequency shift vanishes. The reflection coefficient is $(\Omega_s/\Omega_i)^3(1\text{-}1/m)$ where Ω_i and Ω_s are the frequencies of the incident and scattered e.m. waves. A formula which includes the effect of mismatch is also given. With only one wave damped the reflection coefficient is (Ω_s/Ω_i). This difference can be understood by a simple energy argument. We also show that the complete time dependence can be obtained in the threshold regime $(m\text{-}1 << 1)$.

6088 **(DOE/DP/40124—60) Operational characteristics of the OMEGA short-wavelength laser fusion facility.** Soures, J.M.; Hutchison, R.; Jacobs, S.; McCrory, R.L.; Peck, R.; Seka, W. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 1984. Contract AC08-80DP40124. 15p. (CONF-841010—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002819.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

Twelve beams of the OMEGA, 24 beam direct-drive laser facility have been converted to 351-nm wavelength operation. The performance characteristics of this short-wavelength facility will be discussed. Beam-to-beam energy balance of +-2.3% and on-target energy, at 351-nm, in excess of 70 J per beam have been demonstrated. Long-term performance (>600 shots) of the system has been optimized by appropriate choice of index matching liquid, optical materials and coatings. The application of this system in direct-drive laser fusion experiments will be discussed.

6089 **(DOE/DP/40124—62) Parametric processes in underdense uv laser-produced plasmas.** Tanaka, K.; Boswell, B.; Craxton, R.S.; Goldman, L.M.; Seka, W.; Short, R.W.; Soures, J.M.; Bahr, R.; Guglielmi, F. (Rochester Univ., NY (USA). Lab. for Laser Energetics). 29 Oct 1984. Contract AC08-80DP40124. 15p. (CONF-841010—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002812.

From Meeting of the Plasma Physics Division of the American Physical Society; Boston, MA, USA (27 Oct 1984).

We report on studies of uv laser plasma interactions in underdense plasmas, usig a single beam (λ/sub L/ = 351-nm, E/sub L/ < 50 J, I/sub L/ ≦ 10^{15} W/cm²) incident on foam targets. Average densities of these targets were 2n/sub c//3, n/sub c//3 and n/sub c//10 (n/sub c/: critical density). We observe extraordinary correlation between the Brillouin backscatter signal and the 3ω/2 emission as a function of irradiation intensity, indicative of possible coupling between these parametric processes.

6090 **(DOE/DP/40124—68) Absorption physics at 351 nm in spherical geometry.** Richardson, M.C.; Craxton, R.S.; Delettrez, J.; Keck, R.L.; McCrory, R.L.; Seka, W.; Soures, J.M. (Rochester Univ., NY (USA). Lab. for Laser Energetics). Nov 1984. Contract AC08-80DP40124. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002625.

The primary elements of absorption and energy partition for spherical targets irradiated by nanosecond 351 nm laser radiation from six beams of the OMEGA facility have been characterized. The advantages of uv radiation over 1053 nm radiation for increased absorption, and significantly reduced hot-electron production are demonstrated.

6091 **(DOE/ER—0045/12) Alloy development for irradiation performance. Semiannual progress report for period ending March 31, 1984.** (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 204p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE84016683.

Separate abstracts were prepared for each of the included sections. (MOW)

6092 **(DOE/ER—0046/17) Damage analysis and fundamental studies. Quarterly progress report, January-March 1984.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). May 1984. 153p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE84016957.

Separate abstracts were prepared for each of the included sections. (MOW)

6093 **(DOE/ER—0046/18) Damage analysis and fundamental studies. Quarterly progress report, April-June 1984.** (USDOE Office of Energy Research, Washington, DC. Office of Fusion Energy). Aug 1984. Contract AC06-76FF02170. 163p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85002680.

Separate abstracts were prepared for each of the included sections. (MOW)

6094 **(ENEA-RT/FIMA—83-7) Chain of codes for temperature and stress analysis in the toroidal magnet of a Tokamak.** Cenacchi, G.; Mengoli, P.; Taroni, A. (ENEA, Rome (Italy)). 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85700158.

The revised version of three codes (RETE, FORTE, STROM) evaluating the stress, both mechanical and thermal, acting on the toroidal field magnet of a Tokamak is presented. The use of these codes in a chain is also explained and an example of their application is given.

6095 **(GA-A—17664) Annual report to DOE of the GA Technologies Inc. Fusion Program, fiscal 1983.** Ohkawa, T.; Wesley, J.C. (GA Technologies, Inc., San Diego, CA (USA)). Sep 1984. Contract AT03-76ET51011. 126p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85003156.

The progress of research and experimentation carried out at GA Technologies with the support of the United States Department of Energy and directed at developing magnetic fusion is reviewed for the period 1 October 1982 through 30 September 1983. This report covers progress in Doublet III operations, theoretical science, experimental science, and in the area of fusion development and technology.

6096 **(GA-A—17742) Doublet III US/Japan cooperation upgrade program, final technical report, May 1979-September 1984.** Fox, C.H.; Davis, L.G.; Harder, C.R.; Shoolbred, K.C. (GA Technologies, Inc., San Diego, CA (USA)). Oct 1984. Contract AT03-80SF11512. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85003059.

The US/Japan agreement provided for sharing of Doublet III experimental time between scientific teams from GA and the Japan Atomic Energy Research Institute (JAERI), and also provided for upgrading the experimental capabilities of Doublet III with additional power systems, plasma heating capability, and plasma diagnostic systems.

6097 **(HEDL-SA—3177-FP) Reduced activation guidelines in perspective.** Doran, D.G.; Heinisch, H.L.; Mann, F.M. (Hanford Engineering Development Lab., Richland, WA (USA)). 26 Sep 1984. Contract AC06-76FF02170. 18p. (CONF-841246—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003015.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

The US Fusion Materials program recently adopted a requirement that structural alloys qualify for shallow land burial at end of life. In the absence of a directly applicable regulation, the activation limits currently being used are taken from a US Nuclear Regulatory Commission regulation, 10CFR61, developed to handle existing waste streams from the commercial nuclear industry. Activation calculations are characterized by many uncertainties, e.g., in nuclear data, in handling of multi-step reactions, in appropriate neutron flux-spectra, in component lifetimes, and in the viability of isotopic tailoring. These uncertainties, coupled with uncertain regulatory criteria, mean that calculated concentration limits should be viewed only as a qualitative guide in developing reduced activation materials.

6098 **(JAERI-M—83-061) Calculation of absolute fission-rate distributions measured in graphite reflected lithium oxide blanket assembly.** Seki, Yasushi; Maekawa, Hiroshi; Oyama, Yukio; Ikeda, Yujiro; Nakamura, Tomoo; Kawasaki, Hiromitsu. (Japan Atomic Energy Research Inst., Tokyo). Apr 1983. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE84703238.

The fission-rate distributions of ^{232}Th, ^{238}U, ^{237}Np and ^{235}U have been measured in a pseudo-spherical graphite reflected lithium oxide (Li_2O-C) assembly in 1978. The 14 MeV neutrons were generated at the center of the assembly by the D-T reaction with a 300 kV Cockcroft-Walton type accelerator called PNS-A. The fission rates are calculated using the newly evaluated nuclide densities and current nuclear data. As a result, the calculated and measured fission rates mostly agreed within the estimated experimental error. The agreement is particularly good in the Li_2O region indicating the validity of the calculated neutron spectra in the region. The calculation underestimates the ^{232}Th fission rate in the graphite region. The calculation overestimates the ^{238}U fission rate by about 15% in the graphite region near the Li_2O region.

6099 **(ORNL-MIT—66) Methods of tritium recovery from molten lithium.** Farookhi, R.; Rogers, J.E. (Massachusetts Inst. of Tech., Oak Ridge, TN (USA). School of Chemical Engineering Practice). 18 Dec 1968. Contract AC05-84OR21400. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002584.

It is important to keep the tritium inventory in a blanket of a thermonuclear reactor at a low level both to eliminate possible hydriding of structural components and to reduce inventory cost. Removing the tritium from a lithium blanket by fractional distillation, flash vaporization, and fractional crystallization was investigated. No definitive data are available either on the vapor-liquid equilibrium between lithium and tritium at low T_2 concentrations, or on the rate of formation and decomposition of lithium tritide. The final distinction between the recovery systems discussed in this report will depend on such data, but presently distillation appears to be the best alternate to the diffusion scheme proposed by A.P. Fraas. The capital cost of equipment necessary to remove tritium by distillation appears to be greater than 10 million dollars for a 5000 MW system, whereas the capital cost associated with the diffusion process has been estimated to be 4 million dollars.

6100 **(SAIC—84-1341-PRI-82) Finite-β optimization of tandem mirrors.** D'Ippolito, D.A.; Francis, G.L.; Myra, J.R. (Science Applications, Inc., Boulder, CO (USA). Plasma Research Inst.). Sep 1984. Contract AC03-76ET53057. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002658.

A previously developed numerical algorithm for optimizing tandem mirror coil design with respect to plasma stability and radial confinement is extended to include plasma diamagnetic effects on the magnetic field. Within the context of an approximate equilibrium model, it is shown that nearly omnigenous (transport free) tandem mirror designs with good finite-β stability can be obtained by this technique.

6101 **(SAND—82-2393C) Nuclear microprobe and its application to controlled fusion research.** Doyle, B.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 23p. (CONF-841218—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002633.

From 31. national vacuum symposium; Reno, NV, USA (3 Dec 1984).

A nuclear microprobe analysis system attached to Sandia's EN tandem Van de Graaff accelerator is described. A magnetic quadrupole doublet lens is used for the final focus to obtain beams of 2 μm diameter. Several illustrative applications of the microprobe involving its use in the 1D, 2D and 3D profiling analysis of fusion reactor components are given.

6102 **(UCID—20166-Vol.3) Special topics reports for the reference tandem mirror fusion breeder: beryllium lifetime assessment. Volume 3.** Miller, L.G.; Beeston, J.M.; Harris, B.L.; Wong, C.P.C. (Lawrence Livermore National Lab., CA (USA)). Oct 1984. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002575.

The lifetime of beryllium pebbles in the Reference Tandem Mirror Fusion Breeder blanket is estimated on the basis of the maximum stress generated in the pebbles. The forces due to stacking height, lithium flow, and the internal stresses due to thermal expansion and differential swelling are considered. The total stresses are calculated for three positions in the blanket, at a first wall neutron wall loading of 1.3 MW/m^2. These positions are: (a) near the first fuel zone wall, (b) near the center, and (c) near the back wall. The average lifetime of the pebbles is estimated to be 6.5 years. The specific estimated lifetimes are 2.4 years, 5.4 years, and 15 years for the first fuel zone wall, center and near the back wall, respectively.

6103 **Materials needs for compact fusion reactors.** Krakowski, R.A. (Los Alamos National Lab., NM (USA)). *Journal of Nuclear Materials;* **122**: No. 1-3, 37-50(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

Also published as report LA-UR--83-2570; CONF-830942--39.

The economic prospects for magnetic fusion energy can be dramatically improved if for the same total power output the fusion neutral first-wall (FW) loading and the system power density can be increased by factors of 3-5 and 10-30, respectively. A number of 'compact' fusion reactor embodiments have been proposed, all of which would operate with increased FW loadings, would use thin (0.5-0.7 m) blankets, and would confine quasi-steady-state plasma with resistive, water-cooled copper or aluminum coils. Increased system power density (5-15 MWt/m^3 versus 0.3-0.5 MW/m^3), considerably reduced physical size of the fusion power core (FPC), and appreciably reduced economic leverage exerted by the FPC and associated physics results. The unique materials requirements anticipated for these compact reactors are outlined relative to similar needs for the mainline approaches. Surprisingly, no single materials need that is unique to the compact systems is identified; crucial uncertainties for the compact approaches must also be addressed by the mainline approaches, particularly for in-vacuum components (FWs, limiters, divertors, etc.). 37 refs.

6104 **Evaluation of candidate blanket materials for fusion reactor blanket applications.** Smith, D.L. (Argonne National Lab., IL (USA). Fusion Power Program). *Journal of Nuclear Materials;* **122**: No. 1-3, 51-65(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

This paper summarizes the primary candidate materials currently considered for major components, viz., structure, breeder, coolant, etc. Compatible combinations of materials that offer the most potential for satisfactory performance and the projected ranges of operating parameters are indicated. Critical properties of the candidate materials that limit blanket performance are defined

and the areas of greatest uncertainty are identified. General characteristics of the materials systems that are potentially favorable or unfavorable for the specific application are evaluated. Based on the above assessment, a perspective of the relative importance of various materials limitations and design criteria on the projected performance and blanket lifetime is presented.

6105 **Materials for impurity control.** Mattas, R.F.; Smith, D.L.; Abdou, M.A. (Argonne National Lab., IL (USA). Fusion Power Program). *Journal of Nuclear Materials;* **122**: No. 1-3, 66-79(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

The materials data base for candidate impurity control materials is reviewed. The plasma side materials considered are Be, C, SiC, TiC, and W, and the heat sink materials considered are copper alloys and vanadium alloys. The properties which are evaluated are physical and chemical sputtering, bulk properties, and irradiation properties. Design implications on design are also discussed. 64 refs.

6106 **Characterization of potential aerosols from fusion energy systems.** Hoover, M.D.; Seiler, F.A.; Newton, G.J.; Rothenberg, S.J. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). *Journal of Nuclear Materials;* **122**: No. 1-3, 827-832(May 1984). (CONF-830942—). Contract AC04-76EV01013.

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

This report describes the collection and characterization of airborne particles from a number of fusion-related processes including cutting of stainless steel, vaporization of targets in two inertial confinement fusion devices, debris from the walls of a magnetic confinement device, plasma spraying for applying metal coatings, and burning of lithium metal. Such information on particle formation is needed to plan adequate respiratory protection for workers, predict the life expectancy and performance of reactor components, and develop effective cleanup and maintenance procedures.

6107 **Observation of highly elongated field reversing electron rings.** Parker, M.R.; Taggart, D.P. (School of Applied and Engineering Physics, Cornell Univ., Ithaca, NY). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-12**: No. 1, 19-21(Mar 1984).

Recent experiments on RECE-Christa showed trapping of field-reversing electron rings with large length-to-radius ratios L/R $\lesssim$ 6, compared with L/R $\approx$ 1-2 observed so far. These rings translated stably over axial distances of up to 20 ring radii. Their self-field δ B /SUB z/ (initially up to 2.6 B /SUB z0/) decayed smoothly with L/R remaining roughly constant.

6108 **A study of magnetic diverter properties in the WISTOR-U ultimate torsatron.** Buckle, K.A.; Shohet, J.L. (Torsatron/Stellarator Laboratory, Univ. of Wisconsin-Madison, Madison, WI). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* **PS-12**: No. 1, 2-4(Mar 1984).

The WISTOR-U ultimate torsatron design was modeled to determine the effect of various vertical coil configurations particularly with respect to divertor properties. The separatrix and divertor behavior were studied using a modified version of a previously developed code. The divertor properties were studied for various vertical field coil configurations and strengths. The possibility of using structural members for vertical coils and the resultant divertor action around the structural members was investigated. A reduction in area inside the separatrix was observed with deviations from the pure ultimate torsatron base case.

6109 **Dose rates from induced activity in the Elmo Bumpy torus proof-of-principle device.** Alsmiller, R.G.; Barish, J.; Barnes, J.M.; Santoro, R.T. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Technology/Fusion;* **4**: No. 3, 491-497(Nov 1983).

Calculated results of the dose rates from induced activity in the enclosure of the ELMO Bumpy Torus proof-of-principle device (EBT-P) are presented. A cylindrical model of EBT-P is used. EBT-P will have a hydrogen plasma and thus the plasma will not produce neutrons, but substantial numbers of photoneutrons will be produced and it is the induced activity from these photoneutrons that is considered. The activation dose rates are presented for a variety of operating times and times after shutdown. Dose rates about5 to 10 mrem/h at 1 h after shutdown are obtained and the major contributor to the dose rate at 1 h after shutdown is found to be ^{24}Na (half-life = 15.0 h).

6110 **An analysis of activation and the impact of tritium breeding media and structural materials for a commercial tokamak fusion reactor design.** Jung, J. (Argonne National Laboratory, Argonne, IL). *Nuclear Technology/Fusion;* **4**: No. 3, 566-585(Nov 1983).

Activation analysis has been conducted for several primary fusion blanket materials based on a model of a commercial tokamak fusion reactor design, STARFIRE. The blanket materials studied include two solid tritium breeders, viz., Li_2O and α-$LiAlO_2$, and four candidate structural materials, viz., PCA stainless steel, V15Cr5Ti, Ti6Al4V, and Al-6063 alloys. The importance of breeder material activation is identified in terms of its impurity contents such as potassium, iron, nickel, molybdenum, and zirconium trace elements. The breeder activation is also discussed with regard to its potential for recycling and its impact on the lithium resource requirements. The structural material activation is analyzed based on two measures, volumetric radioactivity concentration and contact biological dose due to decay gamma emission. Using the radioactivity concentration measure, it is revealed that a substantial advantage exists from a viewpoint of radwaste management, which is inherent in fusion reactor designs based on potential low-activation alloys such as V15Cr5Ti, Ti6Al4V, and Al-6063. On the other hand, from the dose standpoint, the V15Cr5Ti alloy is found to be the only alloy for which one could realize a significant dose reduction (below 2.5 mrem/h) within about100 yr after shutdown, possibly by some extrapolation on alloy purification techniques.

6111 **A heat pipe concept for cooling a liquid-pool blanket of a tandem mirror fusion reactor.** Schwertz, N.L.; Hoffman, M.A. (University of California, Department of Mechanical Engineering, Davis, California). *Nuclear Technology/Fusion;* **4**: No. 3, 479-490(Nov 1983).

The performance potential of a heat pipe designed specifically to operate in the high magnetic fields of a fusion reactor is investigated analytically. The heat pipe has a thin, flat cross section aligned parallel to the magnetic field so as to reduce the eddy currents and the resultant magnetohydrodynamic pressure drops in the liquid wick flow. The flat heat pipes are used to cool a pool of liquid lithium (or lithium-lead eutectic) in the blanket that surrounds the central-cell plasma of a tandem mirror fusion reactor. Calculations indicate that this new heat pipe design may be able to transport up to about6800 W/cm^2 of condenser cross-sectional area in a 2-T magnetic field. This is considerably higher than the 420 W/cm^2 capability of a conventional cylindrical heat pipe of similar dimensions employing a channel wick and operating in the same 2-T field.

6112 **Contribution of activation products to fusion accident risk: Part II. Effects of alternative materials and designs.** Holdren, J.P.; Fetter, S. (University of California, Berkeley Energy and Resources Group, Berkeley, California). *Nuclear Technology/Fusion;* **4**: No. 3, 599-619(Nov 1983).

Comparison of accident-hazard potentials associated with neutron-activation products in fusion reactors of various designs and structural materials suffers from a number of shortcomings in the readily available hazard-index data. Neither inventories of curies nor biological hazard potentials (BHPs) are satisfactory indices of hazard even if consistently computed, and between-study inconsistencies in neutronics packages and BHP calculations further obscure the meaning of comparisons based on these measures. The authors present here the results of internally consistent calculations of radioactive inventories, BHPs, and off-site dose potentials associated with the first walls of nine reactor-design/first-wall-material combinations. A recent mirror-reactor design reduces off-site dose

potentials by a factor of 2 compared to a muchstudied early tokamak, for a given first-wall material. Holding design fixed, HT-9 ferritic steel offers a factor of 2 reduction in dose potential compared to Type 316 stainless steel. By the dose-potential measure, molybdenum is the worst of the materials investigated and silicon carbide is by far the best. Hazards in realizable accidents depend not only on the hypothetical dose potentials, as calculated here, but also on the actual release fractions of first-wall (or other activated) material. Review of the theoretical and experimental evidence bearing on release fractions suggests that, for most candidate materials, high release fractions from designs containing liquid lithium cannot yet be convincingly ruled out.

6113 **Radioactivation characteristics for the tokamak fusion test reactor.** Ku, L.P.; Kolibal, J.G. (Princeton Univ., Plasma Physics Lab., Princeton, NJ). *Nuclear Technology/Fusion;* 4: No. 3, 586-598(Nov 1983).

The characteristics of the neutron-induced radioactivities have been studied for the Tokamak Fusion Test Reactor (TFTR) on both the global and local scales. The global radioactivation properties are illustrated by the dose rate contours near the tokamak for a number of typical cases, based on two-dimensional poloidal model transport calculations. Although calculations on this scale require the omission of many details of the machine design, it nevertheless yields valuable information on the spatial variations of the doses. On the local scale, the activation properties of individual materials have been studied by a systematic analysis which covers a typical set of materials and neutron flux spectra. The data necessary to correlate the operational history, the object size, and the observational distances are presented so that interpolation or extrapolation of the activation properties can be made for the situations that have not been covered. The results yield the necessary correction to the global picture, and also provide the necessary information for the assessment of the problems associated with waste disposal, radioactive material transport, and decommissioning for the TFTR. Although the study is specifically for the TFTR, the methods of approach and the results should also be useful for the analysis of activation on other fusion devices.

6114 **Radioactivation characteristics for deuterium-tritium fusion reactors.** Cheng, E.T. (GA Technologies Inc., San Diego, CA). *Nuclear Technology/Fusion;* 4: No. 3, 545-560(Nov 1983).

Deuterium-tritium fusion neutrons, peaked at 14.1 MeV, can activate the materials employed in a fusion reactor. The radioactivation characteristics and level of activation that occurs in a fusion reactor after shutdown depend on the elements that are activated, the neutron wall loading, the duration of the exposure, and the neutron flux spectrum present. The radioactivity resulting from potential elements considered in fusion reactor designs is discussed. The dominating radionuclides and the levels of activation resulting from exposure of these elements to the neutron flux spectrum in the first-wall region of a typical Li_2O solid-breeder fusion reactor blanket are also given.

6115 **Prospects for low-activity aluminum structures.** Powell, J.R.; Fillo, J.A. (Brookhaven National Laboratory, Dept. of Nuclear Energy, Upton, NY). *Nuclear Technology/Fusion;* 4: No. 3, 561-565(Nov 1983).

High-purity, low-activity powder metallurgy aluminum alloys can be developed for use in a fusion reactor at 300 to 400°C using helium as a heat transfer medium. Hot water as a coolant may limit aluminum to 200°C. From a heat transfer point of view, based on the dual- or two-temperature design approach, commercial fusion reactor blanket designs appear to be feasible. To meet all of the blanket design requirements feasibility requires quantification of thermal hydraulics, materials, neutronics, and material responses. Also, radiation damage and lifetime analyses are key issues for design qualification. Based on tests performed to date, aluminum appears well suited for experimental fusion reactors operating at wall temperatures below 200°C.

6116 **Low activation fusion rationale.** Hopkins, G.R.; Cheng, E.T. (GA Technologies Inc., San Diego, CA). *Nuclear Technology/Fusion;* 4: No. 3, 528-544(Nov 1983).

The potential problems of radioactivation in the materials surrounding a neutron-producing fusion plasma were identified over 8 yr ago. At the same time, the use of low activation materials such as graphite, silicon carbide (SiC), and aluminum alloys was proposed for the structural material in fusion power reactors as a way to greatly reduce the major problems of radioactivity resulting from the more conventional stainless steel materials. A brief review of the current status of the reasons for low activation fusion is presented. Design studies with the low activation materials are not covered here. The consequences of low activation fusion are compared with stainless steel fusion structures and it is found that the radioactivity after reactor shutdown, as measured in curies, may be reduced by a factor of 1 000 000. Even then, this limit is determined by impurities in the materials rather than the low activation materials themselves. Problems from decay heat with potential meltdown are reduced for aluminum and completely eliminated for SiC and graphite. Contact or hands-on maintenance may be performed in regions immediately behind the blanket that otherwise require fully remote operations. Small amounts of radioactive waste materials may be stored in surface facilities for the low activation concept. This is compared to the conventional steel systems where high-level radwaste geologic storage facilities may be required. Preliminary projected incremental costs for low activation fusion do not appear excessive but cost/benefit analyses are needed to evaluate the optimum degree of activation reduction. Low activation fusion can help assure the full potential of fusion in providing an environmentally benign energy source with a high degree of safety and public acceptance.

6117 **The FED-INTOR activity.** Stacey, W.M.; Abdou, M.A.; Montgomery, D.B.; Rawls, J.M.; Schmidt, J.A.; Shannon, T.E.; Thome, R.J. (Georgia Institute of Technology, Atlanta, Georgia). *Nuclear Technology/Fusion;* 4: No. 2 PTL, 202-225(Sep 1983).

A set of critical technical issues affecting near-term tokamak reactors has been addressed by a broad cross section of the U.S. fusion community. The results of this work have guided the evolution of an improved concept for a tokamak experimental reactor. An overview of a two-volume report is presented.

6118 **Wildcat: A commercial deuterium-deuterium tokamak reactor.** Evans, K.; Baker, C.C.; Barry, K.M.; Brooks, J.N.; Clemmer, R.G.; Finn, P.A.; Jung, J.; McGrath, R.T.; Misra, B.; Stevens, H.C. (Argonne National Laboratory, Fusion Power Program, Argonne, Illinois). *Nuclear Technology/Fusion;* 4: No. 2 PTL, 226-236(Sep 1983).

WILDCAT is a conceptual design of a catalyzed deuterium-deuterium tokamak commercial fusion reactor. WILDCAT utilizes the beneficial features of no tritium breeding, while not extrapolating unnecessarily from existing deuterium-tritium (D-T) designs. The reactor is larger and has higher magnetic fields and plasma pressures than typical D-T devices. It is more costly, but eliminates problems associated with tritium breeding and has tritium inventories and throughputs approximately two orders of magnitude less than typical D-T reactors. There are both a steady-state version with Alfven-wave current drive and a pulsed version. Extensive comparison with D-T devices has been made, and cost and safety analyses have been included. All of the major reactor systems have been worked out to a level of detail appropriate to a complete conceptual design.

6119 **Survey of reactor aspects of compact fusion concepts.** Gross, R.A. (Coloumbia Univ., School of Eng. and Applied Science, New York, NY). *Nuclear Technology/Fusion;* 4: No. 2 PT 1, 305-326(Sep 1983).

A compact fusion reactor is one that has a higher power density and, for the same total power, is significantly smaller than a conventional magnetic fusion reactor. This survey reviews the principal physics and technology employed by compact fusion power plants. Each of these concepts has been proposed as a fusion power source and rudimentary power plant designs exist. The concepts reviewed are: compact reversed-field pinch reactors, the Ohmically Heated Toroidal Experiment reactor, TRACT, field-reversed mirror reactor, spheromak, field-reversed theta pinch, compact tokamak reactors, dense Z-pinch reactor, imploding liner reactors, and the wall-confined fusion reactor.

6120 **The technology of compact fusion reactor concepts.** Krakowski, R.A.; Dabiri, A.E.; Glancy, J.E. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Technology/Fusion;* 4: No. 2 PT. 1, 342-367(Sep 1983).

An identification of future engineering needs of compact high-power-density approaches to fusion power is presented. After describing a rationale for the compact approach and a number of compact fusion reactors, key technology needs are assessed relative to the similar needs of the conventional tokamak in order to emphasize differences in required technology with respect to the well-documented mainline approaches.

6121 **Nucleonics of a Be-Li-Th blanket for the fusion breeder.** Lee, J.D. (Lawrence Livermore National Lab., Univ. of California, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 805-810(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The nuclear performance of a candidate fissionsuppressed, U233-producing blanket is assessed. It is predicted to have a breeding ratio (fusile + fissile) of 1.68 and produce U233 at a rate of 8030 kg/year from 3140 MW of DT fusion and a blanket coverage of 96%. Blanket energy multiplication is estimated to vary between 1.3 and 2.0 as the U233/Th232 ratio varies between 0 and 0.5%. Heterogeneous effects in the blanket's pebble bed configuration were found to be important and more detailed analysis is needed to more accurately predict Li6 content required and U233 fission power versus U233 content.

6122 **Design and analysis of the Solid Breeder Integral Simulation Test for PE-II.** Deis, G.A.; Hsu, P.Y. (EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Nuclear Technology/Fusion;* 4: No. 2, 791-796(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The PE-II Solid Breeder Concept Integral Simulation Test is designed to simulate (by way of nonnuclear heating) the thermal-hydraulic/ thermomechanical operating characteristics of a water-cooled, Li_2O fusion reactor blanket. The test piece consists of a central coolant tube surrounded by a cylinder of solid breeder material. This test piece, which simulates a unit cell of a blanket, is then subjected to an external heat flux and a purge flow of helium at carefully controlled conditions. Instrumentation provides information on temperature profiles, moisture levels, and purge flow conditions. Pretest thermal/stress analysis of this experiment indicates that it can provide an accurate simulation of actual conditions in a prototypical fusion reactor blanket.

6123 **Large area surface heating facility (ASURF) and test program for first wall design concepts.** Michael, H.D.; Lempert, J. (Westinghouse Electric Corp, Advanced Energy Systems Div., Madison, PA 15663). *Nuclear Technology/Fusion;* 4: No. 2, 785-790(Sep 1983). (CONF-830406—).

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The Westinghouse design and operation of the Large Area SURface Heating Facility (ASURF) has been performed under the sponsorship of the DOE Office of Fusion Energy and the direction of Argonne National Laboratory. Test programs involving ASURF will provide engineering data on components for near term projects and baseline data to resolve issues in the selection and confirmation of promising concepts for fusion reactor first walls. The PE-I test program focuses on the thermomechanical and thermohydraulic performance of in-vessel components. This paper describes ASURF, its capabilities and a discussion of its initial operation.

6124 **Thermomechanical testing of First Wall test pieces in ESURF.** Easoz, J.R.; Bajaj, R. (Westinghouse Electric Corporation-Advanced Energy Systems Div., Madison, PA 15663). *Nuclear Technology/Fusion;* 4: No. 2, 780-784(Sep 1983). (CONF-830406—).

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This paper reports work performed under Program Element I (PE-I) of the First Wall, Blanket, and Shield Program, the principal objectives of which are the testing of first wall design concepts to support the design of fusion reactor first walls and the verification of analytical techniques and design tools. The test facility, ESURF, consists of a 36 kW continuous duty electron beam, evacuated target chamber, and a 6.9 MPa water loop for active cooling of test pieces. Long pulse "steady state" surface heat loads are simulated by rastering the beam in two dimensions, while disruption heat loads are simulated by imposing a focused, stationary beam for a fixed length of time on the target area. Initial test pieces consisted of stainless steel (Type 316) tubes. Tests to date have included thermal-hydraulic characterization of the specimens, thermal cycling up to 500 cycles, disruption heat load simulations, and combined disruption heat loads with thermal cycling. The test results reported here address the verification of predicted thermomechanical response of the specimens, the effects of disruption heat loads on surface melting and crack formation, and the affect of thermal cycling on crack formation/propagation.

6125 **Emergency cooling of the MARS LiPb blanket.** Sze, D.K.; White, A. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 775-779(Sep 1983). (CONF-830406—).

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The thermal effect of a loss of flow accident and afterheat to the MARS blanket are investigated. The temperature response of the first wall, as well as the whole blanket, is calculated with a finite difference method. For a loss of flow accident, the plasma has to be quenched within 10 to 35 seconds, beyond which loss of the first wall may occur. Active cooling will be required for the blanket for afterheat within the first day after the plasma is shut off. After the first day, the reflector will provide a heat sink for passive cooling of the blanket.

6126 **An assessment of critical thermal-hydraulic problems in a deuterium-tritium solid breeder blanket.** Misra, B.; Clemmer, R.G.; Smith, D.L. (Argonne National Laboratory, Fusion Power Program, Argonne, IL). *Nuclear Technology/Fusion;* 4: No. 2 PT 1, 253-262(Sep 1983).

Steady-state thermal-hydraulic analyses were carried out for the DEMO/STARFIRE fusion reactor based on solid breeder blankets and pressurized water as the coolant. The results of the parametric studies show that a coolant in-tube design, i.e., coolant tubes embedded in solid breeder blanket, with a contact resistance between the coolant tube and the solid breeder tailored to maintain the operating temperature window (i.e., the maximum and the minimum temperature imposed on the solid breeder) is viable. However, design of such a solid breeder blanket will present serious challenges because of uncertainty in the thermophysical properties of breeder materials, the narrow operating temperature window, the close manufacturing tolerances necessary to control the gap conductance, the sensitivity of tritium inventory and tritium extraction to breeder temperature distribution, and the deleterious effect of neutron irradiation on breeder material properties. The study shows that even modest uncertainties in the thermal conductivity of solid breeders, interfacial gap conductances, and operating power levels can have significant impact on blanket design. Therefore, the designer should include the expected variations in these parameters. Experimental programs are needed to quantify the above factors and to develop methods (e.g., insulated coatings) for gap conductance control and in situ recovery of tritium via helium purge gas channels.

6127 **Ohmic heating solenoid design utilizing forced cooled windings.** Srivastava, V.C. (Oak Ridge National Lab., P.O. Box Y, FEDC Building, Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 930-935(Sep 1983). (CONF-830406—).

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This paper discusses the feasibility of using NbTi internally cooled cable superconductor (ICCS) in the ohmic heating central solenoid for the fusion engineering device (FED). The ICCS con-

ductor provides cryostable operation with liberal stability margin. The forced cooled concept has a high winding current density which reduces the size and the cost of the device. The forced cooled concept requires complex helium manifolding, but a unique approach has been developed to solve the problem. The conductor design, the winding design and the performance analyses are described. The solenoid is designed to operate at 8-T peak field and provides 60 MAT. The operating current for the solenoid is 21.3 kA, which is 60% of the critical current at 8 T.

6128 **Poloidal field superconducting ring coil case and support structure design.** Hooper, R.J.; Hunter, B.L. (Oak Ridge National Lab., P.O. Box Y, FEDC Building, Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 936-941(Sep 1983). (CONF-830406—).

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Conceptual design studies have been carried out at the Fusion Engineering Design Center (FEDC) on a succession of tokamak devices. In order to quickly assess the technical feasibility and to estimate the costs of competing poloidal field (PF) systems, it is desirable to develop simple, but accurate, rules for the structural design of these coils. In this paper the authors describe the rules developed for superconducting ring coils and illustrate their application to a specific example. This methodology may be easily adapted to resistive ring coil design.

6129 **Novette pulse power system description.** Gritton, D.G.; Christie, D.J. (Lawrence Livermore National Lab., P.O. Box 5508, L-494, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 955-960(Sep 1983). (CONF-830406—).

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Novette is a large, two beam, two wavelength laser facility at Lawrence Livermore National Laboratory. The Novette laser projected performance exceeds that of the 20 arm Shiva laser and the frequency multiplying capability provides more efficient target interaction. Novette is comprised of two arms of the Nova laser. New designs allow these two arms to exceed the performance of the 20 arms of Shiva. Assembling these two arms on an accelerated schedule allowed the experimental program to continue with minimum interruption. The laser has been operational since January 1983. More efficient laser amplifiers allowed the performance to be achieved with half the capacitor bank used on Shiva. The pulse power for Novette uses high-density capacitors, instrumented dual ignitron switches, 100 KVA power supplies and a control system based on LSI/11 Front End Processors (FEP's) and fiberoptic links. The bank contains 11 MJ of stored energy at 22 KV. Construction of the pulse power system took a year. The laser was completed in about 15 months. This paper is a summary of the pulse power systems for Novette; the flashlamp power system, the pulsers for the various optical shutters and the pulse power control system.

6130 **The technology of neutral beam injection based on positive ion sources.** Menon, M.M. (Oak Ridge National Lab., Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 625-631(Sep 1983). (CONF-830406—).

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Injection of energetic neutrals of hydrogen and deuterium has been used effectively to heat plasma in several fusion experiments. All applications to date have used neutral beams with pulse lengths in the subsecond range. The injected power extends into the megawatt level, approaching 10 MW in the case of PDX and D-III, with beam energies in the range of 20 to 80 keV. Key tokamak experiments are planned in which neutral beam injection will be applied at power levels extending toward the 25-MW range. A major difference in the injectors being planned for the future from those operating today lies in their need for longer pulse lengths. Extending the pulse lengths at higher power levels and a high beam brightness is the major goal of the neutral beam development laboratories. Other development areas include improving the atomic fraction in the beam to nearly 100%, increasing the beam brightness, and reducing the impurity content in the beam. Lifetime and reliability are also important considerations. This paper summarizes the advances made in each of these areas and elaborates on the work at Oak Ridge National Laboratory. Neutral injection parameters for a variety of fusion devices are also presented.

6131 **Optimization of steady-state beam-driven tokamak reactors.** Mikkelsen, D.R.; Singer, C.E. (Princeton Univ., Plasma Physics Laboratory, Princeton, NJ). *Nuclear Technology/Fusion;* 4: No. 2 PT1, 237-252(Sep 1983).

Recent developments in neutral beam technology prompt us to reconsider the prospects for steady-state tokamak reactors. A mathematical reactor model is developed that includes the physics of beam-driven currents and reactor power balance, as well as reactor and beam system costs. This model is used to find the plasma temperatures that minimize the reactor cost per unit of net electrical output. The optimum plasma temperatures are nearly independent of β and are roughly twice as high as the optimum temperatures for ignited reactors. If beams of neutral deuterium atoms with near-optimum energies of 1 to 2 MeV are used to drive the current in a reactor the size of the International Tokamak Reactor, then the optimum temperatures are typically T /SUB e/ $\simeq$ 12 to 15 keV and T /SUB i/ $\simeq$ 17 to 21 keV for a wide range of model parameters. Net electrical output rises rapidly with increasing deuterium beam energy for E /SUB b/ $\leqq$ 400 keV, but rises only slowly above E / SUB b/ about 1 MeV. We estimate that beam-driven steady-state reactors could be economically competitive with pulsed-ignition reactors if cyclic-loading problems limit the toroidal magnetic field strength of pulsed reactors to $\leqq$ 85% of that allowed in steady-state reactors.

6132 **Cascade: A centrifugal-action solidbreeder reaction chamber.** Pitts, J.H. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 967-972(Sep 1983). (CONF-830406—).

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The Cascade concept uses the high-temperature (1200 K) potential of a solid Li_2O pebble blanket in conjunction with centrifugal action to produce a safe and highly efficient (up to 55%) reaction chamber for commercial power production. One option using a 25-mm-thick steel wall is shown to have low primary stresses of 22 MPa, which when coupled with a secondary thermal stress of 132 MPa, satisfies the intent and methodology for an ASME-designed vessel. A high tritium breeding ratio of 1.35 results from direct exposure of the Li_2O blanket to the fusion reactions. Vacuum pumping requirements of the chamber, using laser drivers at a pressure of 0.1 Torr, are a modest 4.7 m^3/s for D-T and 3.1 m^3/s for helium. Carbon-14 activation in the blanket is insignificant. It is concluded that that the Cascade concept offers an attractive option for a safe and efficient inertial fusion reaction chamber.

6133 **Light ion fusion target development facility preconceptual design.** Moses, G.A.; Peterson, R.R. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 961-966(Sep 1983). (CONF-830406—).

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The light ion fusion target development facility will be used to test high yield ICF targets (50200 MJ) at the rate of 10 shots per day. The 6 meter diameter cylindrical target chamber is designed as a first wall supported by a structural frame and is capable of withstanding 15,000 full yield shots over a 5 year lifetime. It is made from Al 6061, thus greatly reducing induced activity. The chamber is shielded by a water pool to allow easy access.

6134 **Repetitive pulsed power technology for inertial confinement fusion.** Presturich, K.R.; Buttram, M.T. (Sandia National Lab., Pulsed Power Applications Dept. 1240, Albuquerque, NM 87185). *Nuclear Technology/Fusion;* 4: No. 2, 945-954(Sep 1983). (CONF-830406—).

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The pulsed power requirements for inertial confinement fusion reactors are defined for ion beam and laser drivers. Several megajoule beams with 100's of terrawatt peak powers must be delivered to the reactor chamber 1-10 times per second. Ion beam

drivers are relatively efficient requiring less energy storage in the pulsed power system but more time compression in the power flow chain than gas lasers. These high peak powers imply very large numbers of components for conventional pulse power systems. A new design that significantly reduces the number of components is presented.

6135 **An ICF reactor concept using ^{3}He-AFLINT targets.** Miley, G.; Stubbins, J. (Fusion Studies Lab., Univ. of Illinois, Urbana, IL 61801). *Nuclear Technology/Fusion;* 4: No. 2, 889-894(Sep 1983). (CONF-830406—).

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Alternate fuel configurations which enable tritium to be bred within the target itself could provide a significant advantage for ICF reactors. The present work considers a D-fueled target (termed the "AFLINT" concept) for this purpose. A target design is proposed that provides recycle of tritium for manufacture of subsequent targets in a "closed cycle" fashion. ^{3}He is also recycled to obtain optimum burn conditions. For reactor studies, a Hg^{+1} heavy ion beam driver and a dual liquid-fall reactor chamber are considered. The chamber concept employs a thin inner liquid-fall to absorb the x-rays and target debris while a second outer fall serves to recondense the vaporized liquid, protect the first structural wall against neutron damage, and absorb the radial momentum transfer from the disintegrating inner fall. This design allows a compact geometry (i.e. high power density) while avoiding excessive pumping power requirements for the liquid metal falls.

6136 **Neutron activation and shielding of the Light Ion Fusion Target Development Facility.** O'Brien, K.J.; Moses, G.A. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 883-888(Sep 1983). (CONF-830406—).

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It has been proposed to surround the target chamber of the Light Ion Fusion Target Development Facility with a water shield. Such a shield would effectively isolate the radioactive chamber from the environment while providing a medium in which to absorb energy imparted to the target chamber walls following the impact of the fireball. Radioactivity calculations will be presented for five different wall materials. If the water surrounding the chamber provides a damping mechanism for the wall vibrations, it also provides a medium through which a pressure pulse can be transmitted to the outer wall of the shield region. It is desirable to minimize the pressure loading upon this structure. An investigation of the effects of a bubble screen upon the propagation of the water pressure wave is presented, along with some possible criteria for the design of a screen.

6137 **Dynamic stress analysis of light ion fusion target development facility reaction chambers.** Lovell, E.G.; Engelstad, R.L. (Univ. of Wisconsin, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 878-882(Sep 1983). (CONF-830406—).

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Preliminary structural analysis and design is presented for the reaction chamber of a preconceptual light ion beam target development facility (TDF). The chamber consists of a capped, reinforced cylindrical shell submerged in a water shield. Axisymmetric response is determined for blast waves generated by target ignition. From the analysis, design curves are developed for dynamic displacements and flexural stresses of the shell wall. It is shown that the added mass effect of the water can substantially reduce the response and that a practical design is possible for a range of geometric parameters and materials.

6138 **First wall materials selection in the Light Ion Beam Target Development Facility.** Peterson, R.R.; Lovell, E.G. (Nuclear Engineering Dept., Univ. of Wisconsin, 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 872-877(Sep 1983). (CONF-830406—).

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The choice of material for the first wall of the Light Ion Beam Target Development Facility is discussed. Materials considered are A1 6061, A1 5086, 304 stainless steel, HT-9 (ferritic steel), Ti-6A1-4V, Cu-Be C17200, and Cu-Be C17600. The thermal response, mechanical response and induced radioactivity in first walls made of each of these materials are calculated. Minimum thicknesses of these walls are determined and cost estimates are made for the material requirements for each wall. Finally A1 6061 is suggested as the best choice of first wall material.

6139 **Inertial confinement fusion with direct electric generation by magnetic flux compression.** Lasche, G.P. (Lawrence Livermore National Lab., Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 866-871(Sep 1983). (CONF-830406—).

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A high-power-density laser fusion reactor concept is investigated in which directed kinetic energy imparted to a large mass of liquid lithium--in which the fusion target is centrally located--is maximized. In turn, this kinetic energy is converted directly to electricity with, potentially, very high efficiency by work done against a pulsed magnetic field applied exterior to the lithium. Because the concept maximizes the blanket thickness per unit volume of lithium, neutron-induced radioactivities in the reaction chamber wall can be many orders of magnitude less than is typical of D-T fusion reactor concepts.

6140 **Vaporization of Pb and Li films in ICF reaction chambers.** Hassanein, A.U.; Croessmann, C.D. (Fusion Power Program, Argonne National Lab., Building 205, Argonne, IL 60439). *Nuclear Technology/Fusion;* 4: No. 2, 849-853(Sep 1983). (CONF-830406—).

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The A*THERMAL code is used to calculate the temperature rise and subsequent evaporation of liquid Pb and Li films bombarded with the debris of ICF targets. Temperature increases resulting from the various species are combined with vapor pressure data to yield evaporation rates and the subsequent total amount of Pb or Li vaporized from a thermonuclear explosion.

6141 **Neutronics analysis of the modular stellarator power reactor UMTOR-M.** El-Guebaly, L.A. (Nuclear Engineering Dept., Univ. of Wisconsin, 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 829-834(Sep 1983). (CONF-830406—).

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Neutronics and photonics analysis for UWTOR-M was carried out to assess radiation streaming effects on reactor performance. The effect the lithium enrichment in the $Li_{17}Pb_{83}$ breeder has on radiation streaming was investigated. Using an enrichment of 35% was found to yield an adequate tritium breeding ratio of 1.08 and an overall energy multiplication of 1.153. The bulk shield was optimized to reduce the radiation effects in the superconducting magnets with the limited shielding space available in the design. Detailed analysis for the radiation streaming into the divertor regions has been performed. The divertor targets were found to recover 91% of the streaming energy.

6142 **The dependence of neutron-induced radioactivity in fusion reactors on geometric design parameters.** Lasche, G.P.; Blink, J.A. (Lawrence Livermore National Lab., Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 823-828(Sep 1983). (CONF-830406—).

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Although the neutron-induced activation in a fusion reactor is a non-linear problem whose solution requires the use of neutron transport codes and neutron activation and decay codes, a number of simple arguments can be made which give useful scaling laws for the total radioactivity in a fusion reactor. Because these laws rely heavily on assumptions of linearity and the smallness of second-order effects, the authors have compared them to the results of computer experiments designed to investigate their validity over

the range of operating parameters typical of fusion reactors. The parameters that were varied for comparison of activation and decay were reactor power level, first wall thickness, neutron source distribution (point or homogeneous), first wall radius, and reactor configuration (spherical or cylindrical).

6143 **Critical heat flux enhancement using local tangential flow injection.** Weede, J.; Dhir, V.K. (School of Engineering and Applied Science, Univ. of California, Los Angeles, CA 90024). *Nuclear Technology/Fusion;* 4: No. 2, 483-488(Sep 1983). (CONF-830406—).

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In this study, the critical heat flux (CHF) in subcooled flow of Freon-113 through short vertical tubes has been investigated. In addition, the concept of local tangential flow injection has been studied as a means of CHF enhancement. The data without tangential injection (axial flow) indicate that there is an effect of heated length in the limit of very short tubes. The CHF data obtained with tangential injection show as much as 67% enhancement in CHF over axial flow data at the same conditions. In addition, it has been shown that local tangential injection could be utilized in non-uniform heating situations.

6144 **D-D tokamak reactor assessment.** Baxter, D.C.; Dabiri, A.E. (Science Applications, Inc., P.O. Box 2351, La Jolla, CA 92038). *Nuclear Technology/Fusion;* 4: No. 2, 246-251(Sep 1983). (CONF-830406—).

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A quantitative comparison of the physics and technology requirements, and the cost and safety performance of a d-d tokamak relative to a d-t tokamak has been performed. The first wall/blanket and energy recovery cycle for the d-d tokamak is simpler, and has a higher efficiency than the d-t tokamak. In most other technology areas (such as magnets, RF, vacuum, etc.) d-d requirements are more severe and the systems are more complex, expensive and may involve higher technical risk than d-t tokamak systems. Tritium technology for processing the plasma exhaust, and tritium refueling technology are required for d-d reactors, but no tritium containment around the blanket or heat transport system is needed. Cost studies show that for high plasma beta and high magnetic field the cost of electricity from d-d and d-t tokamaks is comparable. Safety analysis shows less radioactivity in a d-d reactor but larger amounts of stored energy and thus higher potential for energy release. Consequences of all postulated d-d accidents are significantly smaller than those from d-t reactor tritium releases.

6145 **Energy losses on tokamak startup.** Murray, J.G.; Rothe, K.E. (Fusion Engineering Design Center/PPPL, Oak Ridge National Lab., P.O. Box Y, Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 1486-1490(Sep 1983). (CONF-830406—).

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The energy loss in a torus vessel during startup is now an important factor in a power-producing tokamak design. The torus design cannot be based on a system which minimizes the conductivity with resistive structures as in present experimental devices. If the resistivity of the torus is too high, the reactors are subject to damage from an uncontrolled fast shutdown such as a disruption. The thermal and magnetic stored energy due to the plasma current loop is several hundred megajoules, which can produce melting of the torus wall. To prevent excessive damage, a low resistance passive circuit must be provided close to the plasma edge. Another desirable design feature is to make all vacuum seals as far away from the plasma as practical. Thus, the reactor torus designs need an inner low resistance shell and an outer high resistance shell. In addition, the superconducting dewar and coil support structures provide paths for toroidal currents to flow. The calculations provided in this paper can be used to determine the size and cost of the systems as a function of the resistances of the structures. The results can thus be used to guide the preliminary concepts for the electromagnetic characteristics of a tokamak.

6146 **Use of advanced programmable logic controllers to monitor and control the Elmo Bumpy Torus-proof-of-principle device.** Boyd, B.A. (McDonnell-Douglas Astronautics Co., P.O. Box 516, St. Louis, MI 63166). *Nuclear Technology/Fusion;* 4: No. 2, 1503-1508(Sep 1983). (CONF-830406—).

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The Elmo Bumpy Torus - Proof-of-Principle (EBT-P) device is designed with an instrumentation and control system based upon the use of an advanced Programmable Logic Controller (PLC). The modern PLC incorporates many advanced programming features not available in earlier PLC's intended for application to conventional relay logic replacement. The additional power and flexibility of these modern PLC's is especially applicable to an experimental device such as EBT-P which is made up of several complex interrelated subsystems whose operational characteristics will be evolving throughout the lifetime of the device. The rationale for the selection of advanced PLC's for EBT-P and the approach taken to design of the software developed to control EBT-P are the topics addressed in this paper.

6147 **High field tokamaks with DD-DT operation and reduced tritium breeding requirements.** Bromberg, L.; Cohn, D.R. (Plasma Fusion Center, Massachusetts Inst. of Technology, Cambridge, MA 02139). *Nuclear Technology/Fusion;* 4: No. 2, 264-269(Sep 1983). (CONF-830406—).

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DD-DT operation could provide a significant reduction in tritium breeding requirements in high field tokamak reactors without requiring very large increases in reactor size or plasma beta. Operation with the tritium breeding requirement γ = triton provided by blanket/fusion neutrons produced = 0.7–0.9 is of particular interest. The reduced tritium breeding requirement makes possible the use of blanket designs which might be difficult to implement in a DT reactor (for example, $LiAl_5O_8$ blankets). The reduced blanket requirement could also be used for excess tritium production. Tradeoffs between tritium breeding and plasma performance requirements are investigated. Illustrative design features are developed for devices using both resistive magnets and superconducting magnets. Parameters for the device with superconducting magnets are B /SUB T/ = 7 T, β = 0.063, R = 9.6 m, a = 2.4 m, γ = 0.8, and P /SUB wall/ = 2.2 MW/m^2.

6148 **A d-d tandem mirror reactor with central cell potential modification.** Shuy, G.W.; Dobrott, D. (Science Applications, Inc., P.O. Box 2351, La Jolla, CA 92038). *Nuclear Technology/Fusion;* 4: No. 2, 252-257(Sep 1983). (CONF-830406—).

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A conceptual tandem-mirror reactor (TMR) configuration consists of a solenoidal central-cell with its ends plugged by a combination of electrostatic and magnetic fields. The magnetic fields in the end plug also provide MHD stability. The electrostatic plugs for ions and electrons are created by combining hot electron plasmas and neutral beams for fueling and pumping. A large negative potential may be formed in the end plug to contain central cell electrons, but the central cell floating potential /phi/ /SUB f/ is driven negative as charge neutrality is maintained. Cat-d TMR plasma performance is assessed with respect to standard (positive), neutral and negative central cell potential operating modes. It is determined that the plasma Q for a 2000 MW fusion power reactor is peaked for central cell potential /phi/ /SUB f/ near zero. This is because on one hand, the ion-loss cone is bigger for positive /phi/ /SUB f/ and the ion plug electrons must overcome larger /phi/ / SUB f/ + /phi/ /SUB c/ and hence more ECH is required to build the ion plug, and, on the other hand, the electron loss-cone is bigger for negative /phi/ /SUB f/ and synchrotron losses are severe. A zero-dimensional plasma physics model for the density and power balance of a Cat-d TMR has been developed from an existing code that models a d-t TMR operating with a positive central cell potential. The new Cat-d code models all potential operating modes and has been benchmarked.

6149 **Tritium-assisted D-D based fusion - breeders.** Greenspan, E.; Miley, G.H. (Univ. of Illinois, Fusion Studies Lab., 103 S. Goodwin Avenue, Urbana, IL 61801). *Nuclear Technology/Fusion;* 4: No. 2, 167-172(Sep 1983). (CONF-830406—).

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A preliminary assessment of the prospects of tritium assisted D-D based fusion-breeders (FB) is performed. For this purpose, the D-T STARFIRE and the Cat-D WILDCAT tokamak designs are converted into FB's. Two tritium sources are considered for T-assistance - the FB blanket (using L /SUB i/ or ^{3} /SUB He/) and the client fission reactors. The TCD modes of operation, in which the ^{3}He exhausted from the plasma is converted in the blanket into T which is fed back to the plasma, are found most promising of all D-D based FB's. Their profitability is somewhat lower than that of the D-T FB's, but they offer ≈ 50% higher support ratio and simpler blanket designs. T-assistance from client reactors might significantly improve the economics of FB's.

6150 **Parametric study of LH current drive for FED-A.** Iida, H.; Ehst, D.A. (Japan Atomic Energy Research Inst., Naka-machi, Ibaraki-ken). *Nuclear Technology/Fusion;* 4: No. 2, 146-151(Sep 1983). (CONF-830406—).

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In the design of FED-A, quasi-steady state operation is conceived in which the plasma current is generated by the transformer coil in the burning phase and by the lower hybrid wave in the transformer-recharging phase. A parametric study was made to obtain optimum plasma and wave parameters in the recharging phase. The plasma current saturates when rf wave power increases. In order to avoid a hollow current distribution we should choose the rf power level which gives current saturation. The saturation current level is very sensitive to the width of the wave spectrum. The optimum plasma density and n should be determined so that the saturation current reaches to the required level and the efficiency is maximized for a given Δ n.

6151 **Alternate fuels in fusion reactors.** Dobrott, D. (Science Applications, Inc., P.O. Box 2351, La Jolla, CA 92038). *Nuclear Technology/Fusion;* 4: No. 2, 339-347(Sep 1983). (CONF-830406—).

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Alternate fusion fuels, i.e., fuels based on cycles other than d-t, are advocated because of apparent safety and environmental advantages, such as low activation of reactor materials and the relaxation of the requirement for tritium breeding that one needs for a d-t fusion reactor. Nevertheless, the lower fusion reaction rates and the higher required operating temperatures have suggested that the reactor performance would be inferior to that of a d-t reactor. This question of reactor performance relative to fuel cycle is examined here in the restricted context d-t versus d-d (with variations) in tokamaks, reversed-field pinches and tandem mirrors, although results relative to other concepts and cycles are reviewed. Each reactor concept is assessed relative to the relevant physics, engineering, cost and safety issues. There are distinct physics and technical leverages for each of the concepts, but many common features as well. For example, all three concepts require no blanket tritium breeding and have a much lower tritium inventory than their d-t counterparts, as well as, longer blanket lifetime, greater blanket efficiency, higher neutron energy multiplication and less activation. The physics constraints are not necessarily greater and cost per net power output between d-t and d-d reactors can be comparable.

6152 **Construction of the Tokamak Fusion Test Reactor.** French, J.W.; Fedor, B.J. (Ebasco Services Inc., Forrestal Campus, CN59, Princeton, NJ 08544). *Nuclear Technology/Fusion;* 4: No. 2, 326-335(Sep 1983). (CONF-830406—).

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The TFTR construction project is reviewed in three significant phases - Conceptual/Preliminary Design; Final Design/Procurement; and Installation/Assembly. Project organization and responsibilities of major participants are described. A brief discussion on management systems and control including Budgets, Schedules, Costs and Funding is followed by a description of the initial phase of the project highlighting key design issues, engineering tradeoffs, and related research and development programs. Discussion of the Final Design/Procurement Phase focuses on engineering evolution and design changes including selected component problems. The Installation/Assembly Phase of TFTR is described in its significant operations including assembly plans and methods; the role of craft labor in construction of the device; and the problems inherent in large component-close tolerance construction.

6153 **The Mirror Fusion Test Facility: An intermediate device to a mirror fusion reactor.** Karpenko, V.N. (Lawrence Livermore National Lab., Univ. of California, P.O. Box 5511/L-636, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 308-315(Sep 1983). (CONF-830406—).

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The Mirror Fusion Test Facility (MFTF-B) now under construction at Lawrence Livermore National Laboratory represents more than an order-of-magnitude step from earlier magneticmirror experiments toward a future mirror fusion reactor. In fact, when the device begins operating in 1986, the Lawson criteria will almost be achieved for D-T equivalent operation, thus signifying scientific breakeven. Major steps have been taken to develop MFTF-B technologies for tandem mirrors. Steady-state, high-field, superconducting magnets at reactor-relevant scales are used in the machine. The 30-s beam pulses, ECRH, and ICRH will also introduce steady-state technologies in those systems.

6154 **Utility evaluation of the d-t starfire and d-d wildcat reactors.** Jensen, B.K.; Endicott, R.D. (Public Service Electric and Gas Company, 80 Park Plaza, Newark, NJ 07101). *Nuclear Technology/Fusion;* 4: No. 2, 290-295(Sep 1983). (CONF-830406—).

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Public Service Electric and Gas Company (PSE & G) has recently completed an assessment of the Wildcat d-d cycle and Starfire d-t cycle tokamak reactor designs. The purpose of the study was to assess the relative advantages of a d-d cycle reactor for the utility user. These potential advantages relate primarily to safety, siting, and licensing impacts. This paper discusses the overall findings of the assessment. The assessment was performed utilizing existing regulations and judgement based on past experiences of the power generating industry, rather than on "ease of licensing" numerical formulas, since such formulas do not exist. The conclusions represent the input of a group of PSE & G people experienced in power plant siting and licensing, and are intended to provide utility feedback to the fusion engineering community. In the early part of the work the methodology to be used for making the assessment was developed. The key parts of the methodology will be described. The results of the assessment show that the siting, licensing, and safety differences between Starfire and Wildcat are more quantitative than qualitative. The specific Wildcat and Starfire design parameters impacting the siting, licensing, and safety areas, are identified with conclusions and recommendations given.

6155 **The availability analysis of fusion power plants as applied to MARS.** Musicki, F.; Maynard, C.W. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 284-289(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The computer program AVSYS has been developed to analyze the availability of fusion power plants. A parametric study has been conducted on MARS. In order to bring up the availability to acceptable levels redundancy is needed in the neutral beam injection, ECRH, ICRH, direct convertor, and the central cell magnet coils (one coil/side redundant). At the same time, an improvement in quality, maintenance, design (hence failure rates and repair times) is needed for the magnets, as well as the neutral beam subsystem and the direct convertor.

6156 **Limits on transient power variations during startup and shutdown of Li-Pb cooled TMR blankets.** Ghoniem, N.M.; Taghavi, K. (Fusion Engineering and Physics Program, School of Engineering and Applied Science, Univ. of California at Los Angeles, Los Angeles, CA 90024). *Nuclear Technology/Fusion;* 4: No. 2, 769-774(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

Tandem Mirror Reactors are designed to operate at full power, and essentially in a steady-state mode. However, experience with electricity-generating power plants indicate that this is hardly realized due to load variations and frequent subsystem failures. In this paper, the authors investigate the engineering constraints and design requirements during power transients. The study considers the following areas: 1. Analysis of the anticipated base-line load history of TMR's. 2. Transient thermal hydraulics. 3. System pre-heating design. 4. Stress analysis for transient loads, using the newly developed STAIRE code, STress Analysis Including Radiation Effects. As an example, the Mirror Advanced Reactor Study (MARS) is analyzed, and the engineering limits on power variations are identified.

6157 **The Mirror Advanced Reactor Study (MARS).** Logan, B.G. (Lawrence Livermore National Lab., P.O. Box 5511, L-644, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 563-572(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

Progress in a two year study of a 1200 MWe commercial tandem mirror reactor (MARS-Mirror Advanced Reactor Study) has reached the point where major reactor system technologies are identified. New design features of the magnets, blankets, plug heating systems and direct converter are described. With the innovation of radial drift pumping to maintain low plug density, reactor recirculating power fraction is reduced to 20%. Dominance of radial ion and impurity losses into the halo permits gridless, circular direct converters to be dramatically reduced in size. Comparisons of MARS with the Starfire tokamak design are made.

6158 **Demonstration tokamak power plant.** Abdou, U.; Baker, C. (Fusion Power Program, Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL 60439). *Nuclear Technology/Fusion;* 4: No. 2, 579-588(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A conceptual design for a tokamak demonstration power plant (DEMO) was developed. A large part of the study focused on examining the key issues and identifying the R&D needs for: 1) current drive for steady-state operation, 2) impurity control and exhaust, 3) tritium breeding blanket, and 4) reactor configuration and maintenance. Impurity control and exhaust will not be covered in this paper but is discussed in another paper in these proceedings, entitled "Key Issues of FED/INTOR Impurity Control System".

6159 **Tokamak reactor systems code.** Baxter, D.C.; Dabiri, A.E. (Science Applications, Inc., P.O. Box 2351, La Jolla, CA 92038). *Nuclear Technology/Fusion;* 4: No. 2, 599-602(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A tokamak reactor systems code has been developed by combining a previously developed plasma engineering code with an existing reactor systems code and adding calculations for thermal hydraulics, stress analysis, physical sputtering, and neutron activation dose rate. Calculations from the thermal hydraulics and neutron activation dose rate modules are compared with results from more complex codes. The effects on reactor performance of unpredictable properties such as plasma profiles and confinement times are demonstrated.

6160 **Influence of startup, shutdown and staged power operation on tandem mirror reactor design.** Conn, R.W.; Ghoniem, N.M. (Fusion Engineering and Physics Program, School of Engineering and Applied Science, Univ. of California at Los Angeles, Los Angeles, CA 90024). *Nuclear Technology/Fusion;* 4: No. 2, 615-622(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

With the maturity of conceptual fusion reactor designs it is important to develop comprehensive scenarios for the startup and shutdown of fusion plants and to investigate physics and engineering requirements and design constraints and their implications. The authors then focus on the impact of such considerations on the operation of tandem mirror fusion reactors (TMR's). Brief examples from both the fission and conventional power industries are discussed. TMR plant operation is divided into an initial commissioning phase and four subsequent generic phases: (1) Phase IA: cold shutdown; (2) Phase IB: hot shutdown; (3) Phase II: system testing, plasma startup and standby power operation; (4) Phase III: staged power operation; and (5) Phase IV: rated power operation. Power ascention through these phases is explained in terms of the operation of two major systems: (1) the plasma technology and support system, and (2) the heat transport system. Physics and engineering constraints, subsystem interactions, and design implications are discussed throughout the paper using the Mirror Advanced Reactor Study (MARS) as the specific example.

6161 **The SCEPTRE high-temperature reactor concept for inertial fusion.** Monsler, M.J.; Meier, W.R. (Lawrence Livermore National Lab., P.O. Box 5508, Livermore, CA 94550). *Nuclear Technology/Fusion;* 4: No. 2, 979-984(Sep 1983). (CONF-830406—).

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The goal of the SCEPTRE project was to create an advanced second-generation inertial fusion reactor that offers the potential for either generating electricity at 50% efficiency, providing high temperature heat (850°C) for hydrogen production, or producing fissile fuel for light-water reactors. The authors have found that these applications are conceptually feasible with a reactor that is intrinsically free of the hazards of catastrophic fire or tritium release.

6162 **Effect of temperature on magnetic field perturbations from the ferromagnetic blanket in MARS.** Attaya, H.; Kulcinski, G.L. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 471-476(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The effect of temperature variation in the ferromagnetic blanket of MARS on the induced magnetic field from that blanket is studied. A simple analytical model is used to show that the effect will be mainly at the ends of the blanket. Numerical calculations using the computer program GFUN3D are presented and show that the effect is reasonably small.

6163 **Analysis of blanket structure lifetime for the Tandem Mirror Hybrid Reactor.** Ghoniem, N.M.; Berwald, D.H. (Fusion Engineering and Physics Program, School of Engineering and Applied Science, Univ. of California at Los Angeles, Los Angeles, CA 90024). *Nuclear Technology/Fusion;* 4: No. 2, 439-444(Sep 1983). (CONF-830406—).

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Lifetime estimates of blanket components are extremely useful during the design process of fusion reactor blankets. In this paper, authors present a preliminary analysis for the performance of HT-9 in the blanket modules of a reference Tandem Mirror Hybrid Reactor (TMHR). They utilize the available data base for HT-9 as well as other ferritic alloys to develop approximate design equations for void swelling, the shift in the ductile-to-brittle-transition temperature (DBTT), and thermal creep rupture at high temperature. HT-9 is used in a relatively low temperature design (below 500°C) to give an allowable design stress on the order of 145 MP /

SUB a/ for up to 10 operating years. A minimum structure temperature of 365°C is imposed on the design to ensure a good margin of safety against neutron embrittlement. As an added design feature, the moderate DBTT shifts are almost entirely eliminated by a 450°C anneal for 50-60 hours, once every year. The lifetime of the blanket is estimated to exceed 10 years, and is based on the maximum limit for total elastic plus inelastic strains.

6164 **FWBS Program element II: Blanket and shield testing.** Schultz, K.R.; Veca, A.R. (GA Technologies, Inc., P.O. Box 85608, San Diego, CA 92138). *Nuclear Technology/Fusion;* 4: No. 2, 763-768(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The First Wall/Blanket/Shield (FWBS) Program has the goal to provide the development and testing of FWBS systems for magnetic fusion reactors. Program Element II of this program is to develop the thermal-hydraulic and thermomechanical data base for blanket and shield components. The critical blanket/shield data needs were identified, alternate techniques to simulate fusion neutron bulk heating were evaluated, and a detailed technical plan was developed. The initial focus is on the critical issues of solid breeder blankets. Two single effect scoping tests are currently in progress to determine the heat transfer characteristics and thermomechanical stability of the solid breeder bed. The design of an integral test to simulate all the non-nuclear aspects of the blanket has been completed. Preliminary planning for a fission reactor-based nuclear test has also been done. Future testing will investigate alternate solid breeder blanket materials and configurations and will begin the investigation of the critical MHD effects of liquid metal blanket concepts.

6165 **FELIX construction status and experimental program.** Turner, L.R.; Peag, W.F. (Argonne National Lab., Argonne, IL 60439). *Nuclear Technology/Fusion;* 4: No. 2, 745-750(Sep 1983). (CONF-830406—).

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FELIX (Fusion Electromagnetic Induction eXperiment) is an experimental test facility being constructed at Argonne National Laboratory (ANL) for the study of electromagnetic effects in the first wall/blanket/shield (FWBS) systems of fusion reactors. The facility design, construction status, experimental program, instrumentation, and associated computer-code comparisons are described.

6166 **Mechanical and thermal design aspects of the blanket, and maintenance considerations for the central cell in MARS.** Sviatoslavsky, I.N.; Li, Y.T. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 751-756(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

This paper describes the mechanical and thermal design features of the MARS (Mirror Advanced Reactor Study) blanket and presents a credible concept for maintaining the central cell components of the reactor.

6167 **A solid-breeder blanket and power conversion system for the Mirror Advanced Reactor Study (MARS).** Bullis, R.; Clarkson, I. (Grumman Aerospace Corp., Bethpage, NY 11714). *Nuclear Technology/Fusion;* 4: No. 2, 739-744(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A solid-breeder blanket has been designed for a commercial fusion power reactor based on the tandem mirror concept (MARS). The design utilizes lithium oxide, cooled by helium which powers a conventional steam electric generating cycle. Maintenance and fabricability considerations led to a modular configuration 6 meters long which incorporates two magnets, shield, blanket and first wall. The modules are arranged to form the 150 meter long reactor central cell. Ferritic steel is used for the module primary structure. The lithium oxide is contained in thin-walled vanadium alloy tubes. A tritium breeding ratio of 1.25 and energy multiplication of 1.1 is predicted. The blanket design appears feasible with only a modest advance in current technology.

6168 **First wall coating candidates for ICF reactor chambers using dry wall protection only.** Sink, D.A. (Westinghouse Electric Corporation, Advanced Energy Systems Div., Madison, PA 15663). *Nuclear Technology/Fusion;* 4: No. 2, 712-717(Sep 1983). (CONF-830406—).

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Twenty pure metals were considered as potential candidates for first wall coatings of ICF reactor chambers. Seven were found to merit further consideration based on the results of computer code calculations of figures-of-merit. The seven are rhenium, iridium, molybdenum, chromium, tungsten, tantalum, and niobium (listed in order of decreasing values of figures-of-merit). The calculations are based on mechanical, thermal, and vacuum vaporization engineering constraints. A number of alloys of these seven metals are suggested as additional candidates.

6169 **T.F. coil replacement considerations for the FED baseline configuration.** Dietz, L.P. (Grumman Aerospace Corp., Bethpage, NY 11714). *Nuclear Technology/Fusion;* 4: No. 2, 200-205(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A study was conducted to establish the tasks and special equipment required to remove and replace a Toroidal Field (T.F.) coil from the FED baseline configuration and to identify critical design features which might require improvement to facilitate maintenance procedures. It was established that nineteen major tasks must be accomplished prior to T.F. coil removal. Four of these tasks were identified as major problem areas of such magnitude that design reconsideration is mandatory if T.F. coil removal and replacement is to be a viable option. Specific recommendations are made to alleviate difficulties and enhance FED maintainability.

6170 **Plasma engineering analysis of an EBT reactor operating window.** Santoro, R.T.; Uckan, N.A. (Oak Ridge National Lab., Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 491-496(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The operating space for EBT reactors is calculated using a newly developed systems code that incorporates recent advances in EBT physics. The calculation includes a self-consistent treatment of coupled ring-core stability and power balance requirements. The essential elements of the systems code are reviewed including magnetics, stability, ring power, power balance, confinement time, and cost calculations. Finally, a typical reactor systems analysis is summarized for a family of EBT reactors that fall within the allowed operating space.

6171 **Divertor target design for the UWTOR-M modular stellarator power reactor.** Sanders, R.; Sviatoslavsky, I.N. (Univ. of Wisconsin, Nuclear Engineering Dept., 1500 Johnson Drive, Madison, WI 53706). *Nuclear Technology/Fusion;* 4: No. 2, 993-997(Sep 1983). (CONF-830406—).

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Modular stellarators offer a unique opportunity for innovative divertor target design by virtue of the discreteness of their diverted flux bundles. Well focused flux bundles leave the separatrix at discrete locations, emerging from the toroid between the coil legs and then reenter the toroid. This paper describes a divertor target design which recovers the energy at a high temperature and prevents neutron streaming through the divertor slots.

6172 **Summary of the status of negative-ion based neutral beams.** Cooper, W.S. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA 94720). *Nuclear Technology/Fusion;* 4: No. 2, 632-641(Sep 1983). (CONF-830406—).

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Negative-ion-based neutral beam systems can perform multiple functions for fusion reactors, such as heating, current drive in

tokamak reactors, and establishing and maintaining potential barriers in tandem mirror reactors. Practical systems operating continuously at the 200 keV, 1 MW level can be built using present-day technology. Ion sources have been demonstrated that produce D^- beams with <5% electron content, and that operate at linear current densities that are within a factor of 2 of what conservatively designed accelerator/transport structures can handle. Concepts are in hand for transporting the negative ion beam through a neutron maze before neutralization, thus permitting a radiation-hardened beamline. With an advanced laser photoneutralizer, overall system power efficiencies of 70% should be possible. A national program is being planned to achieve the goal of application of 475 keV systems on a mirror ETR in 1994.

6173 **The influence of engineering constraints on confinement time requirements of advanced fuel fusion reactors.** Roth, J.R. (Dept. of Physics, Univ. of Tennessee, Knoxville, TN 37996-2100). *Nuclear Technology/Fusion;* 4: No. 2, 258-263(Sep 1983). (CONF-830406—).

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A survey of large scale DT tokamak design studies shows that the confinement time required to achieve self-sustaining operation can be much less than that predicted by the recently reported neo-Alcator scaling. The excess containment is, in most cases, more than an order of magnitude larger than that required for a steady-state burning plasma. If neo-Alcator scaling remained valid to reactor conditions, means must be found to reduce confinement times to levels consistent with steady-state operation. The problem of excess confinement has not been addressed adequately in the available literature. A positive aspect is that this excess confinement is likely to be available without engineering or physics penalty. A constructive use to which this excess confinement can be put is to burn advanced fusion fuels instead of the DT reaction, and thereby reap the practical benefits of reduced energetic neutron fluxes.

6174 **A success oriented ICF R and D plan for commercial demonstration by 2010.** Steele, W.; Maniscalco, J. (TRW Energy Development Group, One Space Park, R 1/2128, Redondo Beach, CA 90278). *Nuclear Technology/Fusion;* 4: No. 2, 985-990(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A success oriented research and development plan for Inertial Confinement Fusion (ICF) leading to a commercial demonstration reactor by the year 2010 has been generated. The R&D plan was developed by using the unique approach of combining an ICF-experienced project team with technical forecast information obtained through interviews with experts in ICF-relevant technologies. The technical forecast data were analyzed with a logic network formalism to determine preferred R&D options to reach the aggressive 2010 goal. The application of the developed technical forecasting techniques has proved to be a useful planning tool.

6175 **A remote joint system for large vacuum ducts.** Hagmann, D.B.; Coughlan, J.B. (Remote Technology Corp., 114 Union Valley Rd, Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 224-229(Sep 1983). (CONF-830406—).

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A large remote vacuum duct joining system has been developed for fusion machines that uses several two-jaw screwdriven clamps. The preferred location for clamp installation is inside the vacuum duct where access space is available for the actuating device. It also decreases space needed for handling operations exterior to the duct. The clamp system is unique in that it is low cost, applies force directly over the seal, permits leak testing to the seal annulus, is highly reliable, can be remotely replaced, and is usable on a variety of other applications.

6176 **In-vessel maintenance concepts for tokamak fusion reactors.** Berger, J.D.; Kelly, V.P. (Westinghouse Hanford Company, P.O. Box 1970, Richland, WA 99352). *Nuclear Technology/Fusion;* 4: No. 2, 230-233(Sep 1983). (CONF-830406—).

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Concepts for rail-mounted and guided in-vessel handling machines (IVM) for remote maintenance inside tokamak fusion reactors are described. The IVM designs are based on concepts for tethered remotely operated vehicles and feature the use of multiple manipulator arms for remote handling and remote-controlled TV cameras for remote viewing. The concepts include IVMs for both single or dual rail systems located in the top or bottom of the reactor vessel.

6177 **Application of mockups to the resolution of fusion reactor remote maintenance design issues.** Masson, L.S.; Watts, K.D. (EG and G Idaho, Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Nuclear Technology/Fusion;* 4: No. 2, 212-217(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

The use of large, functional mockups as a means to develop fusion reactor remote maintenance technology was examined. Critical remote maintenance requirements were categorized and one example, the removal and replacement of a torus sector, was used to illustrate the use of mockups. A generic mockup system was developed and the engineering issues which could be addressed were listed. Consideration was given to techniques involved in designing and using functional mockups for this purpose.

6178 **Initial temperature profiles of the PDX inner toroidal limiter.** Ulrickson, M.; Kugel, H.W. (Princeton Univ., Plasma Physics Lab., Princeton, NJ 08544). *Nuclear Technology/Fusion;* 4: No. 2, 141-145(Sep 1983). (CONF-830406—).

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The temperature profiles resulting from plasma operation on the PDX vertical, large area, inner toroidal limiter have been measured during both ohmic and neutral beam heated discharges using a scanning infrared camera. An asymmetric double peaked temperature profile is seen after neutral beam heated discharges. Disruptions in ohmically heated discharges are found to be preceded by a single peaked deposition and succeeded by a initially symmetric double peaked deposition. The results were compared with the Schmidt model for scrapeoff at a toroidal limiter and it was found that the measured double peaked temperature profiles yielded scrape-off lengths consistent with previous measurements.

6179 **Fusion Materials Irradiation Test facility: A facility for fusion materials qualification.** Trego, A.L.; Hagan, J.W. (Westinghouse Hanford Company, Hanford Engineering Development Lab, Richland, WA 99352). *Nuclear Technology/Fusion;* 4: No. 2, 695-700(Sep 1983). (CONF-830406—).

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The Fusion Materials Irradiation Test Facility will provide a unique testing environment for irradiation of structural and special purpose materials in support of fusion power systems. The neutron source will be produced by a deuteron-lithium stripping reaction to generate high energy neutrons to ensure damage similar to that of a deuterium-tritium neutron spectrum. The facility design is now ready for the start of construction and much of the supporting lithium system research has been completed. Major testing of key low energy end components of the accelerator is about to commence. The facility, its testing role, and the status and major aspects of its design and supporting system development are described.

6180 **Waste management of first wall and blanket structural materials for tokamak fusion reactors.** Vogler, S.; Steindler, M.J. (Argonne National Lab., 9700 S. Cass Avenue, Argonne, IL 60439). *Nuclear Technology/Fusion;* 4: No. 2, 415-420(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

A comparison has been made of the induced radioactivities in the first wall and structural materials of the breeder blanket in the high flux region for two different fusion reactor types. One

system is the STARFIRE, a tokamak reactor with PCA, a modified stainless steel, as a first wall and a $LiAlO_2$ breeder blanket; the other is a reactor based on the STARFIRE design with a vanadium alloy as the first wall and structural material, and circulating molten lithium as the breeder/ coolant. The recycling or disposal of these structural materials is evaluated.

6181 **PE-II scoping test results: solid breeder heat transfer and stability.** Veca, A.R.; Yang, L. (GA Technologies Inc., P.O. Box 85608, San Diego, CA 92138). *Nuclear Technology/Fusion;* 4: No. 2, 757-762(Sep 1983). (CONF-830406—).

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Two scoping test stands have been designed, built and installed at GA Technologies to perform single effect type testing to investigate specific thermomechanical and thermalhydraulic data needs of typical solid breeder blanket designs. An initial test has been completed successfully yielding important information on the stability of Li_2O breeder material at typical fusion reactor environmental conditions. Assembly of the second test rig and a pre-testing checkout of the equipment has been completed.

6182 **Corrosion behaviour of materials selected for FMIT lithium system.** Bazinet, G.D.; Brehm, W.F. (Westinghouse Kanford Company, P.O. Box 1970, Richland, WA 99352). *Nuclear Technology/Fusion;* 4: No. 2, 718-723(Sep 1983). (CONF-830406—).

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The corrosion behavior of selected materials in a liquid lithium environment was studied in support of system and component designs for the Fusion Materials Irradiation Test (FMIT) Facility. Testing conditions ranged from about 3700 to about6500 hours of exposure to flowing lithium at temperatures from 230° to 270°C and static lithium at temperatures from 200° to 500°C. Principal areas of investigation included lithium corrosion/erosion effects on FMIT lithium system baseline and candidate materials/ Material coupons and full-size prototypic components were evaluated to determine corrosion rates, fatigue crack growth rates, structural compatibility, and component acceptability for the lithium system. Based on the results of these studies, concerns regarding system materials and component designs were satisfactorily resolved to support a 20-year design life requirement for the FMIT lithium system.

6183 **Selection and testing of high current contact materials for tokamak devices.** Banker, D.C. (McDonnell Douglas Astronautics Company, St. Louis Div., P.O. Box 516, St. Louis, MO 63166). *Nuclear Technology/Fusion;* 4: No. 2, 707-711(Sep 1983). (CONF-830406—).

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Materials for potential use in tokamak first wall high current connectors were selected and tested under conditions that might be encountered in tokamak devices. Disk-shaped specimens of promising metal mixtures were subjected to current densities approaching 23 kA/cm^2 (150 kA/in^2) in 8 ms pulses, closing pressures ranging from .07 to 2.1 MPa (10 to 300 psi), and a vacuum of 1.3×10^{-1} Pa (10^{-3} Torr). Contact welding occurred at moderate to low pressure and moderate currents. The resulting welds were very weak, failing at 18-31 N (4-7 lb) in shear.

6184 **The nuclear design of a very low activation fusion reactor.** Cheng, E.T.; Hopkins, G.R. (GA Technologies Inc., P.O. Box 85608, San Diego, CA 92138). *Nuclear Technology/Fusion;* 4: No. 2, 701-706(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

An investigation was conducted to study the nuclear design aspects of using very low activation materials, such as SiC, MgO, and aluminum for fusion reactor first wall, blanket, and shield applications. In addition to the advantage of very low radioactive inventory, it was found that the very low activation fusion reactor can also offer an adequate tritium breeding ratio and substantial amount of blanket nuclear heating as a conventional material structured reactor does. The most stringent design constraint found in a very low activation fusion reactor is the limited space available in the inboard region of a tokamak concept for shielding to protect the superconducting toroidal field coil. A reference design was developed which mitigates the constraint by adopting a removable tungsten shield design that retains the inboard dimensions and gives the same shield performance as the reference STARFIRE tokamak reactor design.

6185 **Superheated steam cycle for a D-D tokamak.** Lee, K.C.; Cherdack, R.N. (Burns and Roe, Inc., 800 Kinderkamack Rd, Oradell, NJ 07649). *Nuclear Technology/Fusion;* 4: No. 2, 603-608(Sep 1983). (CONF-830406—).

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A relatively high temperature superheated steam cycle was designed to be compatible with a D-D tokamak blanket to help identify some of the benefits of using the D-D fuel cycle. Since less tritium leaves the plasma in a D-D reactor than in a D-T reactor and tritium is not produced in the D-D reactor blanket, it may be acceptable for steam generated in the first wall and blanket to be used directly in a turbine generator. Calculations indicated high temperature superheated steam (811K, 12.5MPa) could be generated within the allowable stresses of presently available piping materials.[1] Based on these turbine inlet conditions, a backpressure of 50 mm HgA, 6-feedwater heaters, 1 reheater and a 6-flow cross compound turbine generator, the overall cycle efficiency is estimated to be 40.5%.

6186 **Conceptual design summary for modifying Doublet III to a large dee-shaped configuration.** Davis, L.G.; Gallix, R. (GA Technologies Inc., P.O. Box 85608, San Diego, CA 92138). *Nuclear Technology/Fusion;* 4: No. 2, 609-614(Sep 1983). (CONF-830406—).

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The Doublet III tokamak is to be reconfigured by replacing its indented (doublet) vacuum vessel with a larger one of a dee-shaped cross section. This change will permit significantly larger elongated plasmas than is presently possible and will allow higher plasma current (up to 5 MA) and anticipated longer confinement time. Reactor relevant values of stable beta and plasma pressure are predicted. This modification, while resulting in a significant change in capability, utilizes most of the existing coils, structure, systems and facility.

6187 **FED pumped limiter configuration issues.** Haines, J.R.; Fuller, G.M. (Oak Ridge National Lab., P.O. Box Y, Oak Ridge, TN 37830). *Nuclear Technology/Fusion;* 4: No. 2, 1004-1009(Sep 1983). (CONF-830406—).

From 5. topical meeting on technology of fusion energy; Knoxville, TN, USA (26 Apr 1983).

Impurity control in the Fusion Engineering Device (FED) is provided by a toroidal belt pumped limiter. Limiter design issues addressed in this paper are (1) poloidal location of the limiter belt, (2) shape of the limiter surface facing the plasma, and (3) whether the belt is pumped from one or both sides. The criteria used for evaluation of limiter configuration features were sensitivity to plasma edge conditions and ease of maintenance and fabrication. The evaluation resulted in the selection of a baseline FED limiter that is located at the bottom of the device and has a flat surface with a single leading edge.

6188 **Parametric studies for the fusion engineering device.** Reid, R.L.; Steiner, D. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Technology/Fusion;* 4: No. 1, 120-143(Jul 1983).

Parametric studies were conducted using the Fusion Engineering Design Center (FEDC) systems code to investigate the cost, performance, and engineering sensitivity of variations within the fusion engineering device (FED) design space. Candidate FED missions and the associated fusion devices required to achieve the missions are compared. A brief description of the FEDC systems code and the results of the parametric studies that helped to define the FED baseline design are presented.

6189 Nuclear design and analysis of a deuterium-deuterium tokamak reactor, WILDCAT. Jung, J. (Argonne National Laboratory, Fusion Power Program, Argonne, IL). *Nuclear Technology/Fusion;* **4**: No. 1, 144-163(Jul 1983).

An in-depth nuclear analysis has been performed for WILDCAT that is a conceptual design of a commercial tokamak reactor utilizing a catalyzed deuterium-deuterium (D-D) fusion fuel cycle. Comparisons are made with the deuterium-tritium-fueled STARFIRE design in order to identify the salient features of D-D tokamak reactor designs. Since WILDCAT does not have to breed tritium, the blanket and shield system can be optimized to have a thinner inboard extent (about0.8 versus 1.2 m for STARFIRE) leading to more efficient use of the toroidal field. The nonbreeding blanket concept of WILDCAT can also be utilized for substantial enhancement of the system energy multiplication (2.02 versus 1.14). These benefits help to overcome the reduced fusion reactivities and lead to a 60% more efficient blanket in terms of power generation. The outboard blanket and shield system has been designed for personnel access within 24 h after reactor shutdown and uses as much as possible materials that are not resource limited and that have lower activation. Ninety percent of the materials in WILDCAT can be recycled within 50 yr after their discharge from the reactor.

6190 Investigation of the transport of deuterium-deuterium fusion neutrons in thick concrete. Ku, L.P.; Kolibal, J.G. (Princeton University, Plasma Physics Laboratory, Princeton, New Jersey). *Nuclear Technology/Fusion;* **4**: No. 1, 69-78(Jul 1983).

By altering the collision mechanism in the numerical transport calculations, and by constructing an analytical model based on age-diffusion theory, the outstanding feature in the life history of deuterium-deuterium (D-D) fusion neutrons penetrating deeply into ordinary concrete is shown to be the transport in the 2.3-MeV oxygen antiresonance. This result is used to assess the impact of the cross-section uncertainties and the uncertainties due to variations in the D-D fusion spectrum and temperature.

6191 Nova laser fusion facilitydesign, engineering, and assembly overview. Simmons, W.W.; Godwin, R.O. (Lawrence Livermore National Laboratory, Livermore, California). *Nuclear Technology/Fusion;* **4**: No. 1, 8-24(Jul 1983).

The Nova laser fusion research facility, currently under construction at Lawrence Livermore National Laboratory (LLNL), will provide researchers with powerful new tools for the study of nuclear weapons physics and inertial confinement fusion (ICF). The Nova laser system consists of ten large (74-cm-diam) beams, focused and aligned precisely so that their combined energy is brought to bear for a small fraction of a second on a tiny target containing thermonuclear fuel (deuterium and tritium). The ultimate goal of the LLNL ICF program is to produce fusion microexplosions that release several hundred times the energy that the laser delivers to the target. Such an achievement would make ICF attractive for military and civilian applications. The U.S. Department of Energy has approved construction of ten Nova laser beams, harmonicconversion crystal arrays, and the associated laboratory buildings. By the mid 1980s, Nova will produce the extremes of heat and pressure required to explore the physical region of ignition of the thermonuclear fuel. Additional developments in the area of highefficiency drivers and reactor systems may make ICF attractive for commercial power production.

6192 Princeton large tokamak scaling laws for thermonuclear fusion power multiplication. Grisham, L.R.; Stracham, J.D. (Princeton University Plasma Physics Laboratory, Princeton, New Jersey). *Nuclear Technology/Fusion;* **4**: No. 1, 46-53(Jul 1983).

While present experiments are evaluated on the basis of confinement time, it is the fusion power multiplication factor, Q, and the fusion power that will be the parameters measuring the performance of ignition experiments and fusion reactors. We have determined the relationship of Q to /tau/ /SUB E/ and the Lawson number, /eta//tau/ /SUB E/ , for ohmically heated plasmas from the Princeton large tokamak (PLT). The values Q, /tau/ /SUB E/ , and /eta//tau/ /SUB E/ all increase with density at low densities. Above /eta/ /SUB e/ $\simeq 4 \times 10^{13}$ cm^{-3}, /tau/ /SUB Ee/ $\simeq$ 30 ms, or /eta/ /SUB e/ /tau/ /SUB Ee/ $\simeq 1.2 \times 10^{13}$ cm^{-3} s, Q saturates; Q scaling has also been obtained on PLT as a function of toroidal magnetic field, plasma current, and auxiliary heating power.

6193 Propagation of ions through conducting fluids with imbedded magnetic fields. Bohachevsky, H.O.; Dickman, D.O.; Goldstein, J.C. (Los Alamos National Laboratory, Los Alamos, NM). *Nuclear Technology/Fusion;* **4**: No. 1, 93-101(Jul 1983).

Studies of applications of inertial confinement fusion motivated the development of a plasma model composed of 1. perfectly conducting fluid 2. relatively energetic ions not in thermal equilibrium with the fluid 3. an electromagnetic field. The fluid is modeled as a continuum, but the trajectories of the ions are determined from integration of the equations of motion for a statistically representative sample of simulation particles because the ion ranges in the fluid are comparable to characteristic dimensions of containment vessels. The model constituents interact electrodynamically, collisionally, and through ionization and recombination processes. The model of the collisional interaction is based on the stopping power of the fluid; it leads to technical difficulties because of the widely different characteristic lengths associated with collisional interactions and with macroscopic fluid phenomena. These difficulties are resolved with a specially constructed elementary one-dimensional model of the collisional interaction. The finite difference equations describing the evolution of the complete ion-plasma system are integrated numerically for an isotropic ion source located on the cylinder axis. The solutions indicate different ion behaviors for low- and highfluid densities. The ions expand as a diffuse cloud through low-density fluids, but aggregate into perpendicular-to-the-magnetic-field sheets in high-density fluids; the discovery of these strikingly different behaviors constitutes the main contribution of this work.

6194 Engineering computations at the national magnetic fusion energy computer center. Murty, S. (Lawrence Livermore National Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* **4**: No. 1, 25-33(Jul 1983).

The National Magnetic Fusion Energy Computer Center (NMFECC) was established by the U.S. Department of Energy's Division of Magnetic Fusion Energy (MFE). The NMFECC headquarters is located at Lawrence Livermore National Laboratory. Its purpose is to apply large-scale computational technology and computing techniques to the problems of controlled thermonuclear research. In addition to providing cost effective computing services, the NMFECC also maintains a large collection of computer codes in mathematics, physics, and engineering that is shared by the entire MFE research community. This review provides a broad perspective of the NMFECC, and a list of available codes at the NMFECC for engineering computations is given.

6195 Modeling and analysis of erosion and redeposition for limiter and divertor impurity control systems. Brooks, J.N. (Argonne National Laboratory, Argonne, IL). *Nuclear Technology/Fusion;* **4**: 33-45(Jul 1983).

Erosion and redeposition of sputtered material from a limiter and divertor were analyzed using the REDEP computer code. Both low- and high-Z materials were examined for a wide range of plasma edge temperatures. Redeposition rates are high in most cases, and net erosion rates are predicted to be much smaller than the gross rates. The limiter front face and the entire divertor plate have similar erosion properties. The lifetime of both surfaces depends critically on the redeposition process; under certain conditions relatively long lifetimes may be obtainable.

6196 Deuterium permeation during implantation into type 304 stainless steel. Causey, R.A.; Holland, D.F.; Sattler, M.L. (Univ. of Virginia, Dept. of Nuclear Eng., Charlottsville, VA). *Nuclear Technology/Fusion;* **4**: No. 1, 64-68(Jul 1983).

Tritium implanted into the first wall of a fusion reactor can permeate through the wall and enter the coolant. Since this loss pathway for tritium could be a significant safety concern, an experiment was performed to determine permeation during bombardment of a stainless steel sample with a deuterium ion beam. The results indicate that interaction of the ion beam with the front surface increases deuterium reemission and consequently reduces the perme-

ation rate. The surface modification most likely responsible for this effect is sputter removal of surface oxides.

6197 **Magnetic field errors in quadrupole tandem mirrors.** Hooper, E.B. (Univ. of California, Lawrence Livermore National Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 1, 137-143(Jun 1983).

Coil misalignments in quadrupole tandem mirrors generate dipole and quadrupole field errors. The effects of these errors on the magnetic field are calculated. Misalignments in the thin, quadrupole fans have particularly large effects on field lines. The results are applied to the Tandem Mirror Experiment (TMX) and to the TMX Upgrade.

6198 **Fatigue crack growth in inertial confinement fusion reaction chamber components.** Pitts, J.H. (Univ. of California, Lawrence Livermore Nat. Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 1, 149-151(Jun 1983).

A general three-step method is outlined for analyzing fatigue crack growth under conditions of both steady and fluctuating loads. Application to the HYLIFE reaction chamber shows that it is feasible to manufacture components without defects that would limit the lifetime of the chamber.

6199 **Neutron leakage through fusion chamber ports: A comparison of lithium and lead-lithium blankets.** Meier, W.R. (Univ. of California, Lawrence Livermore Nat. Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 3, 385-391(May 1983).

Monte Carlo neutronics calculations have been carried out to compare the effects of chamber ports on the neutron leakage and blanket performance for lithium and lead-lithium blankets. A spherical chamber with diametrically opposed, conical penetrations through the blanket and a 14.1-MeV point source at its center is the basis for the comparison. The total neutron leakage through ports in a lithium blanket is about two times greater than one would estimate based on the solid angle fraction subtended by the holes. For a blanket comprised primarily of the lead-lithium eutectic, PB_{83} LI_{17}, the leakage per deuterium-tritium neutron is about six times the subtended solid angle fraction. As a result of the enhanced neutron leakage, the tritium-breeding ratio and neutron energy deposited in the blanket decrease more rapidly than the loss of blanket coverage. For example, for a chamber in which the ports subtend 5% of the total solid angle, the tritiumbreeding ratios are about8 and about20% less than the results without ports for the lithium and PB_{83} LI_{17}.

6200 **New scheme for current drive in a tokamak reactor.** Bhadra, D.K.; Chu, C.; Peuron, U.A. (GA Technologies Inc., San Diego, CA). *Nuclear Technology/Fusion;* 3: No. 3, 335-341(May 1983).

The authors have studied the feasibility of an efficient current-drive scheme using radio-frequency (rf) waves on the alpha particles produced in a reactor tokamak. Traveling fast waves, generated as waveguide modes in the plasma, are found to be particularly suitable for implementing such a scheme. The scheme involves using rf power to prohibit the alpha particles from slowing down isotropically and in pushing the alpha particles in a preferential direction and thus form an alpha-particle beam, which, through interaction with electrons, sustains a current. Numerical estimates for the current-drive efficiency were obtained using plasma parameters characteristic of the Argonne National Laboratory design of a reactor tokamak.

6201 **Measurement of deuterium beam energy distribution and species using an electrostatic energy analyzer.** Wekhof, A.; Medley, S.S.; Smith, R.R. (University of California, Lawrence Berkeley Laboratory, Berkeley, California). *Nuclear Technology/Fusion;* 3: No. 3, 462-470(May 1983).

The peak energy, energy broadening, and neutral current fractions for the E, E/2, and E/3 energy components of the prototype Tokamak Fusion Test Reactor 120-keV deuterium neutral beam source were measured on the Neutral Beam System Test Facility at Lawrence Berkeley Laboratory using a 127-deg swept electrostatic energy analyzer provided by the Princeton Plasma Physics Laboratory. The results were compared with Doppler shift spectroscopy measurements, taking into account the different geometrical factors for both methods. The average neutral current fractions for the E, E/2, and E/3 atomic species components measured with the electrostatic analyzer and extrapolated to the target area were 0.35, 0.47, and 0.18, respectively, which agreed with the spectroscopic results to within 5%. For all species, a 1/e full-width energy broadening of $\Delta E/E \simeq 4\%$ was observed for an analyzer energy resolution of both about4 and 1%. This width is not in contradiction with the energy broadening expected due to Franck-Condon dissociation effects. The peak energies for the E, E/2, and E/3 components were within about4% of the rated values, but consistently on the low side of the standard deviation.

6202 **Induced radioactivity and influence of materials selection in deuterium-deuterium and deuterium-tritium fusion reactors.** Youssef, M.Z.; Conn, R.W. (University of California at Los Angeles, School of Engineering and Applied Science, Fusion Engineering and Physics Program, Los Angeles, California). *Nuclear Technology/Fusion;* 3: No. 3, 361-384(May 1983).

The radioactivity, biological hazard potential, and afterheat levels in the deuterium-deuterium (D-D) fuel cycle fusion reactor, SATYR, have been evaluated for two types of structural materials: ferritic steel (HT-9) and sintered aluminum product. Results are compared to the corresponding levels in the deuterium-tritium (D-T) fuel cycle systems, STARFIRE and WITAMIR-I, both during operation and after plant decomissioning. The influence of blanket replacements on the radioactivity levels has been considered in the comparative analysis. It has been found that the long-term radioactivity level (100 to 1000 yr after plant shutdown) in the ferritic steel blanket of the SATYR design is somewhat higher, by a factor of 2 to 6, than that found for a D-T reactor system employing the same structural alloy. The high levels are attributed to the softer spectrum and the larger structure volume fraction encountered in the D-D machines. However, the levels during plant operation (about30 yr) are comparable. Isotopic tailoring and elemental substitution in alloys to reduce the long-term radioactivity levels in the SATYR design are discussed. It is found that three orders of magnitude reduction in radioactivity levels can be achieved by isotopically tailoring the molybdenum in the ferritic steel to 100% ^{97}Mo. The elemental substitution of vanadium for nickel and molybdenum in ferritic steels is shown to reduce long-term radioactivity levels by four orders of magnitude. These low levels at long times after shutdown are below those found for blankets using aluminum alloy structure. The results make clear that elemental composition should be a primary consideration in alloy formulation if the goal of a low radioactivity level in fusion reactor radwaste is to be achieved.

6203 **Radiation-induced swelling in an austenitic alloy: Observations and interpretation of the effects of helium.** Packan, N.H.; Farrell, K. (Oak Ridge National Laboratory, Metals and Ceramics Division, Oak Ridge, Tennessee). *Nuclear Technology/Fusion;* 3: No. 3, 392-404(May 1983).

Microstructural damage is measured in a stable austenitic alloy after nickel-ion bombardment to doses of 1 to 70 dpa at temperatures in the range of 840 to 1100 K. The influence of helium, both preimplanted at room temperature and coimplanted at a rate of 20 at. ppm per dpa, is examined. The helium causes considerable increases in the concentrations of cavities and reductions in cavity size, and shifts the peak swelling temperature upward by about50 K; growth of dislocation loops is delayed. Preimplanted helium has much more pronounced effects than coimplanted helium, including the generation of a large secondary population of small cavities deemed to be helium bubbles, and in some cases submicroscopic bubbles. Cavitation is assessed with regard to the concept of a critical size for bias-driven cavity growth. The results of this experiment are attributed to helium-enhanced cavity nucleation and to the influence of such nucleation on the cavity and dislocation sink strengths.

6204 **Scoping of oil shale retorting with nuclear fusion reactors.** Galloway, T.R. (Univ of California, Lawrence Livermore National Laboratory, Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 1, 73-88(Jan 1983).

An engineering scoping study was conducted at the U.S. Department of Energy's request to see if a feasible concept could be developed for using nuclear fusion heat to improve in situ extraction by retorting of underground oil shale. It was found that a fusion heated, oxygen-free inert gas could be used for driving modified, in situ retorts at a higher yield, using lower grade shale and producing less environmental problems than present-day processes. It was also found to be economically attractive with return on investments of 20 to 30%. Fusion blanket technology required was found to be reasonable at hot gas delivery temperatures of about650°C (920 K). The scale of a fusion reactor at 2.8 GW(thermal) producing 45 000 Mg/day (335 000 barrel/day) was also found to be reasonable.

6205 **Design description of the fusion engineering device.** Steiner, D.; Flanagan, C.A. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Technology/Fusion;* 3: No. 1, 6-52(Jan 1983).

During 1981, the Fusion Engineering Design Center developed a baseline design for the Fusion Engineering Device (FED) called for in the U.S. Magnetic Fusion Energy Engineering Act of 1980. The device has a major radius of 5.0 m with a plasma minor radius of 1.3 m elongated by 1.6. Capability is provided for operating the toroidal field (TF) coils up to 10 T, but the bulk of the operations are designed for 8 T. At 8-T conditions, the fusion power is about 180 MW (neutron wall loading about 0.4 MW/ m^2) and a plasma Q of about 5 is expected. At 10-T conditions, which are expected to be limited to about10% of the total operations, the fusion power is about450 MW (about1.0 MW/m^2) and ignition is expected. Maintenance and cost were the key considerations in developing the design. The plasma chamber is assembled by inserting ten shield sectors into a spool support structure. Ten TF coils (7.4- X 10.9-m bore) are employed and produce a 3.6-T field (8 T) or 4.6-T field (10 T) on axis.

6206 **Test results on plasma direct converters.** Barr, W.L.; Moir, R.W. (Univ. of California, Lawrence Livermore National Lab., Livermore, CA). *Nuclear Technology/Fusion;* 3: No. 1, 98-112(Jan 1983).

The power carried out through the ends of a mirror fusion reactor by escaping plasma can be converted directly into electricity by a plasma direct converter. Test results from three plasma direct converters are described. The first two tests were performed with a steady-state power density up to 70 Q/cm^2 to simulate the predicted conditions on a reactor (about100 W/cm^2). A single-stage unit and a two-stage unit of the venetian-blind type were tested up to 100 kV and 6 kW for a total time of about80h. In scaling up in energy from previous experiments, the new effects that became important were the ionization of background gas and the release of secondary electrons at surfaces. In the third test, a single-stage unit was mounted on the end wall of the Tandem Mirror Experiment (TMX) device where it intercepted some of the end-loss plasma. Of the 138 W incident on the direct converter, 79 W were recovered and 12 W were used to power the suppressor grid. The net efficiency was therefore 48%; this was in good agreement with predictions for a single-stage unit and the TMX plasma parameters. These test results lend confidence to our directconverter designs for fusion reactors. The remaining area of concern includes the general problem imposed by high-voltage breakdown in a large direct converter with many joules of stored energy.

6207 **A maintenance assessment for TFTR near-term remote handling operations.** Spampinato, P.T.; Deutsch, L.; Rathke, J. (Grumman Aerospace Co., Bethpage, NY). pp 1679-1685 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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A preliminary assessment of basic maintenance operations has been compiled for TFTR remote maintenance considerations. These activities are in preparation for a limited number of low-level deuterium-tritium (D-T) pulses which will occur in 1986 for Q=1 operation, followed by Q=2 operation near the end of life for this machine. The approach for this assessment was to focus on the replacement of a limited number of representative components, generally in the category of scheduled maintenance operations. Five zones of maintenance were identified as a function of activation levels; they are: plasma vessel, igloo shield, test cell, inner basement, and outer basement. The activation levels within each zone were determined in order to ascertain the level of fully remote operations necessary. These were derived from neutronic analyses developed by Princeton Plasma Physics Laboratory (PPPL) staff. Representative component replacements were analyzed, and several representative maintenance scenarios for Zones I-III are presented.

6208 **TASKA-M, an optimized tandem mirror device for fusion technology tests.** Arendt, F. (Kernforschungszentrum Karlsruhe, Institut fur Technische Physik, Karlsruhe). pp 1573-1578 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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TASKA-M is a new study of a dedicated fusion technology device based on the mirror principle with the objective of minimizing cost while retaining key requirements of neutron flux and fluence for blanket and material development. A DT-plasma of about 4 m length in a cylindrical central cell is MHD-stabilized by a deuterium plasma in Yin-Yang anchors at each end. All plasmas are maintained by 29 MW of continuously injected neutral beams. Microstability is achieved by sloshing the central cell ions and filling the potential dip with warm plasma. Two hybrid choke coils of 17.5 T provide mirror confinement, and electrons are heated by Landau damping on 12 MW of ICRF power in the central cell. Due to the sloshing ion distribution, the neutron wall load varies between 0.7 and 1.3 MW/m^2. Four test blankets are foreseen with a total axial length of about 3.2 m and 0.4 to 0.5 m diameter. Liquid and solid breeder blankets can be tested in the lower flux regions while material test inserts can be placed in the higher flux regions. The overall direct costs of the machine will be about 400 M $.

6209 **Remote maintenance of tandem mirror hybrid coils.** Dietz, L.P. (Grumman Aerospace Co., Bethpage, NY). pp 1686-1689 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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Hybrid Coils (superconducting coils with normal conducting inserts) are being employed with increasing frequency on Tandem Mirror Devices to obtain high field strengths. The normal conducting copper inserts are short lived in comparison to their encircling superconductors. It becomes desirable, therefore, to devise design features and maintenance procedures to replace the inner normal conducting coils without simultaneously replacing the longer lived (and significantly more costly) superconducting coils. The high neutron wall loadings require that the task be accomplished by remote control. The approach is to permanently mount the coil assemblies on track mounted carriages which serve, during machine operation merely as structural supports, but during maintenance procedures as moveable transport devices. The carriages incorporate all necessary provisions to facilitate remote maintenance operations and to adjust and align the coil assemblies with respect to adjacent machine components. The vacuum vessel is severed on both sides of the hybrid coil by means of a remote cutting machine. The entire coil is transported horizontally, normal to the machine axis to a nearby repair station. Prepositioned carriage mounted repair equipment at the repair station withdraws the damaged normal coil as a single entity and inserts a preassembled spare unit. The repaired hybrid coil is reassembled to the reactor. A cost and risk effective procedure has been evolved to maintain one of the more critical components of a Tandem Mirror Machine.

6210 **Modular design of the advanced Stellarator W VII-AS.** Brossmann, U.; Sapper, J.; Sombach, B. (Max-Planck-Institut fur Plasmaphysik, EURATOM-Association Garching). pp 1569-1572 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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WENDELSTEIN VII-AS is a Stellarator experiment and uses nonplanar coils for the confinement field system. This leads to a modularly designed device with improved access for diagnostic and heating methods. The vacuum vessel and the structure casing also fulfill the conditions of modularity. This paper describes some details of the mechanical engineering design for the three main components of the WENDELSTEIN VII-AS device - vacuum vessel, nonplanar coils and structure.

6211 **Some considerations on silicone oil in high current and energy disconnecting mechanisms.** Vogel, H.F. (Los Alamos National Laboratory, Los Alamos, NM). pp 1658 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Silicone oil is considered inflammable. The dissociation products generated by an electric arc under silicone oil are known to form a highly explosive mixture with air. The authors calculate the arc energy required to be 40 kJ per liter of gas mixture at standard pressure and temperature. They calculate the arc voltage gradient at a pressure of 50 atm and current density of 1 kA/mm^2 to be 0.7 kV/cm, resulting in an arc voltage of several kV, depending on the arc length. In a multikiloampere arc, the resulting arc power is likely to cause a pressure of many atmospheres in a shock-wave, which has been observed. The calculations are based on the MHD equations of a stationary system of ionized multicomponent gas with boundary conditions reported elsewhere. The work was performed for the 25 kA, bypass switches in the Large Coil Project (LCP).

6212 **Inductance calculation of multiconductor high-current transmission lines for pulsed power supplies.** Nudelman, A.; Fromm, N. (Princeton Univ., Plasma Physics Laboratory, Princeton, NJ). pp 1634-1637 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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For fast-switched high current power supplies the precise value of line inductance has to be determined at the design stage. This paper offers an algorithm and computer program for inductance calculation of multiconductor cables. The method renders best results for symmetrical wire configurations. Listed are some limitations concerning result accuracy related to wire configuration and wire number.

6213 **An assessment of thermal storage systems and thermomechanical effects for pulsed reactors.** Misra, B.; Brooks, J.N.; Ehst, D.A.; Majumdar, S.; Stevens, H. (Aryonne National Laboratory, Aryonne, IL). pp 1600-1604 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

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Pulsed operation of fusion power plants has severe impact on all major reactor components. This analysis focuses on the sensitivity of one subsystem, the breeding blanket, to pulsed operation in terms of thermal storage requirements and thermomechanical effects. For analysis, a water-cooled Li_2O breeding blanket (400 MWth, 3.45 MW/m^2 neutron wall loading) was chosen. With the operating temperature window, 800/ 410°C for Li_2O, thermal analysis shows that for the coolant-in-tube design (STARFIRE) there would be 10 rows of coolant tubes in the radial direction of the blanket. Since the thermal inertia of the blanket is larger further away from the first wall, the mixed mean temperature of coolant from all regions will dictate the design requirements for the thermal storage system. Three representative blanket regions were analyzed under four burn scenarios (startup/shutdown time = 10 s, steady-state time = 3600 s, and dwell time = 0, 30, s, steady-state time = 3600 s, and dwell time = 0, 30, 90, and 200 s) to estimate the thermal storage requirements. The size of the thermal storage system is dictated primarily by the energy deficiency that occurs during the dwell/startup and shutdown phase, although time/temperature response of the heat transfer fluid is critical to the design. Only pressurized water/steam and hot sodium thermal storage systems are considered for this study, since alternative systems are not attractive for heat storage of the order of 11 MWh to 230 MWh. An estimation of the size of thermal storge vessels that can be built utilizing current technology shows that reactor systems with dwell times much in excess of 50 s may not be economically viable due to the enormous size of the storage units. An approximate cost analysis indicates that the minimum cost of the

6214 **A computer model of the MFTF-B neutral beam accel dc power supply.** Wilson, J.H. (Lawrence Livermore National Laboratory, Livermore, CA). pp 1595-1599 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Using the SCEPTRE circuit modeling code, a computer model was developed for the MFTF Neutral Beam Power Supply System (NBPSS) Accel DC Power Supply (ADCPS). The ADCPS provides 90 kV, 88 A, to the Accel Modulator. Because of the complex behavior of the power supply, use of the computer model is necessary to adequately understand the power supply's behavior over a wide range of load conditions and faults. The model developed includes all the circuit components and parameters, and some of the stray values. The model has been well validated for transients with times on the order of milliseconds, and with one exception, for steady-state operation. When using a circuit modeling code for a system with a wide range of time constants, it can become impossible to obtain good solutions for all time ranges at once. The present model concentrates on the millisecond-range transients because the compensating capacitor bank tends to isolate the power supply from the load for faster transients. Attempts to include stray circuit elements with time constants in the microsecond and shorter range have had little success because of hugh increases in computing time that result. The model has been successfully extended to include the accel modulator.

6215 **Electrical energy and cost for the mirror fusion test facility.** Pence, G. (Lawrence Livermore National Laboratory, Livermore, CA). pp 1673-1678 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

An operational scenario has been developed for the Mirror Fusion Test Facility (MFTF-B) based on the System Requirements, our experience with existing systems, and discussions with the project engineers and designers who are responsible for the systems. This scenario was used to predict the amount of electrical energy needed for running the facility. A generic type listing is included for the equipment considered in each system. A figure shows the anticipated power drain during a five-minute shot sequence from the 115-kV substation, and from the 230-kV and direct feed substations. At this time, the three major substations that will be used for the MFTF-B are billed under three different rate schedules. A table lists these schedules and what they are anticipated as being when the facility becomes operational. The system availability, which is expected to be 0.7 or better, has not been factored into these calculations. This gives a worst case cost for the MFTF-B. Based on this study, it appears that our energy bill will be over $500 000 per month, on the average. This expenditure will constitute a significant portion of the budget needed to operate the MFTF-B. As the systems are refined, and a more accurate picture is obtained as to the size and operational cycles of the equipment, this report will be updated.

6216 **Steady state analysis of a multiconverter supply system for fusion experiments.** Fellin, L.; Benafatto, I. (Istituto Gas Ionizzati del CNR, Via Gradenigo 6a - I35100 Padova). pp 1668-1672 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

After a short description of the power supply thyristor converters which are proposed to feed the toroidal and poloidal windings of the RFX experiment, the relationship between the AC and DC quantities has been evaluated, taking into account the freewheeling diode performance and the commutation phenomena. The

analytical solution for the current harmonic analysis has been developed for a single thyristor bridge and for different thyristor modules operating simultaneously. Finally, the influence of the converter system on the 380 kV supply network is analyzed.

6217 **Fast breakdown and OHMIC heating circuit for the toroidal Z-PINCH EXTRAP T1.** Bures, M. (Dept. of Plasma Physics and Fusion Research, Royal Inst. of Technology, Stockholm). pp 1625-1628 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The possibility of driving the discharge current of the toroidal EXTRAP T1 device, using the iron core transformer, is investigated. It is shown that the breakdown voltage 20 kV can be supplied, along the zero line of the vacuum magnetic field, at a time shorter than 1μs. This is made possible by the transient build-up of the magnetic field in the core laminations. The plasma current rise time is determined by the evolution of the inductance and resistance of the discharge. This enables the plasma current to be built up to an amplitude I /SUB p/ =50 kA within 10-15μs and sustained at this value during a steady-state period 100μs. The premagnetized iron core of the cross-sectional area 0.16 m^2 is sufficient to provide the necessary flux swing, if the saturation induction is not lower than 1T. To reduce the stray field interfering with the zero line of the octupole field, the high resistivity lamination of thickness d≦.1mm should be employed. Because a rather high voltage pulse is applied to the core, the interlaminar voltage should be reduced by segmenting the core.

6218 **Crosstalk measurement on the D-III neutral beam power supplies.** Nerm, A.; Bowles, E.; Callis, R.W.; Colleraine, A.; Cowels, G.; Finizio, R.; Moore, D.; Tooker, J.F.; Varga, H. (GA Technobgies Inc., San Diego, CA). pp 1616-1620 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Doublet III neutral beam plasma heating system comprises three beamlines with a total of six ion sources. Each of these ion sources is energized from a Neutral Beam Power System (NBPS) which is capable of delivering pulses at 80 kV and 100 A with pulse lengths up to 1 second in duration. A 138 kV San Diego Gas & Electric Company line is used as the prime power source for the NBPS. The 138 kV line is stepped down through an 84 MVA (pulse rating) 138 kV-12.47 kV transformer and an 8 MVA (pulse rating) 138 kV–480 V transformer. The 12.47 kV transformer feeds six NBPS high voltage circuits. The 480 V transformer supplies power to the filament, arc, and auxiliary power systems and control consoles in each NBPS. Each of the NBPS may block (controlled interruption of NBPS to protect the ion source) several times during a shot. Voltage variations due to such blocking by one or more systems have been measured on the 12.47 kV distribution bus as part of an effort to reduce system interaction. Interaction due to blocking during shots was found to be caused by noise picked up in low level circuits during ion source faults. High voltage DC fluctuations due to blocking do not cause interaction unless the voltage sags below the minimum required anode voltage for the pulse tetrodes in the Modular/Regulator, but interaction due to crowbar of the high voltage DC supply by a NBPS may result in a domino effect unless the remaining online systems are caused to block until the crowbarred system is cleared from the line (This feature is not presently implemented.). Voltage sag on the 480 V bus results from simultaneous operation of the ion sources. This sag, when it occurs, may lower the arc power input to the ion sources and cause reduced output power.

6219 **Construction of the JFT-2M TOKAMAK (5) design and fabrication of poloidal coil power supply system.** Narikawa, T.; Ishida, K.; Kameari, A.; Kashino, E.; Masui, H.; Oyabu, I. (Mitsubishi Electric Co., Tokyo). pp 1610-1645 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

JAERI (Japan Atomic Energy Research Institute) TOKAMAK JFT-2M is the equipment with which following experiments will be performed by JAERI. 1 Control of 550KA D-shape cross section plasma. 2 Verification of various suplemental heatings and achievement of high βp (about5) plasma. 3 Current drive by LHRH. 4 Experiments on pump limiters etc. The equipment has been delivered by Mitsubishi Group on the basis of the contract they concluded with JAERI. This thesis is to describe the design, features, structure and manufacturing of the poloidal power supply equipment of JFT-2M.

6220 **Startup experience with the MFTF-B ECRH 100 kV dc power supply.** Bishop, S.R.; Goodman, R.A.; Wilson, J.H. (Lawrence Livermore National Laboratory, Livermore, CA). pp 1663-1667 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

One of the 24 Accel DC Power Supplies (ADCPS) originally intended for the Mirror Fusion Test Facility (MFTF-B) Neutral Beam Power Supply (NBPS) System has been converted to provide negative polarity output at 90 kV with a load current of 64 A dc. The load duty cycle is a pulse of 30-seconds duration with a pulse repetition period of five minutes. A new control system has been built which will serve as a prototype for the MFTF-B ADCPS controls, and a test setup was built which will be used to test the ADCPS. The Electron Cyclotron Resonance Heating (ECRH) DC Power Supply (DCPS) has been tested under both no-load and dummy-load conditions, under remote control, without notable problems. Test results indicate that the power supply should be reliable and safe to operate, and will meet the load duty requirements.

6221 **Sparking protection for MFTF-B Neutral Beam Power Supplies.** Cummings, D.B. (Lawrence Livermore National Laboratory, Livermore, CA). pp 1659-1662 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper describes the upgrade of MFTF-B Neutral Beam Power Supplies for sparking protection. High performance ion sources spark repeatedly so ion source power supplies must be insensitive to sparking. The hot deck houses the series tetrode, arc and filament supplies, and controls. Hot deck shielding has been upgraded and a continuous shield around the arc, filament, gradient grid, and control cables now extends from the hot deck, through the core snubber, to the source. The shield carries accelerating current and connects only to the source. Shielded source cables go through an outer duct which now connects to a ground plane under the hot deck. This hybrid transmission line is a low inductance path for sparks discharging the stray capacitance of the hot deck and isolation transformers, reducing coupling to building steel. Parallel DC current return cables inside the duct lower inductance to reduce inductive turn-off transients. MOVs to ground further limit surges in the remote power supply return. Single point grounding is at the source. No control or rectifier components have been damaged nor are there any known malfunctions due to sparking up to 80 kV output.

6222 **Proposed design criteria for a fusion facility electrical ground system.** Armellino, C.A. (Lawrence Livermore National Laboratory, Univ. of California, Livermore, CA). pp 1654-1657 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Ground grid design considerations for a nuclear fusion reactor facility are no different than any other facility in that the basis for design must be safety first and foremost. Unlike a conventional industrial facility the available fault energy comes not only from the utility source and in-house rotating machinery, but also from energy storage capacitor banks, collapsing magnetic fields and D.C. transmission lines. It is not inconceivable for a fault condition occurrence where all available energy can be discharged. The ground grid must adequately shunt this sudden energy discharge in a way

that personnel will not be exposed by step and/or touch to hazardous energy levels that are in excess of maximum tolerable levels for humans. Fault energy discharge rate is a function of the ground grid surge impedance characteristic. Closed loop paths must be avoided in the ground grid design so that during energy discharge no stray magnetic fields or large voltage potentials between remote points can be created by circulating currents. Single point connection of equipment to the ground grid will afford protection to personnel and sensitive equipment by reducing the probability of circulating currents. The overall ground grid system design is best illustrated as a wagon wheel concept with the fusion machine at the center. Radial branches or spokes reach out to the perimeter limits designated by step-and-touch high risk areas based on soil resistivity criteria considerations. Conventional methods for the design of a ground grid with all of its radial branches are still pertinent. The center of the grid could include a deep well single ground rod element the length of which is at least equivalent to the radius of an imaginary sphere that enshrouds the immediate machine area. Special facilities such as screen rooms or other shielded areas are part of the ground grid system by way of connection to radial branches.

6223 **An overcurrent protection device for neutral beam sources.** Praeg, W.F. (Aryonne National Laboratory, Aryonne, IL). pp 1605-1609 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

Electrical loads connected to capacitance elements in high voltage direct current systems are protected from damage caused by capacitance discharge overcurrents by connecting a longitudinal inductor between the capacitance element and the load. The inductor comprises a bifilar winding wound about a magnetic core, which forms an incomplete magnetic circuit. A diode is connected across a portion of the bifilar winding. Most of the energy discharged from the capacitance element is stored in the inductor and then dissipated, away from the load, in an L-R circuit comprising the diode and the coil winding. Multiple high voltage circuits having capacitance elements may be connected to loads through bifilar windings all wound about the aforementioned magnetic core.

6224 **Mechanical installation of TFTR neutral beam lines.** Perry, E.D. (Princeton Univ., Plasma Physics Laboratory, Princeton, NJ). pp 1565-1568 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The mechanical installation of a TFTR Neutral Beam in the Neutral Beam Test Cell (NBTC) took place between November 1982 and February 1983. This offmachine test area will be used for source development and/or conditioning beginning in 1984. The installation of a Neutral Beam on the TFTR machine was carried out during July and August 1983 and a second Neutral Beam is scheduled to be installed between January and April 1984. These two Neutral Beams should be operational and available for supplemental heating of the TFTR tokamak plasma by the end of 1984. These installations represent the first opportunity for assembling an integrated system of hardware supplied by diverse vendors. This paper discusses the installation and assembly of the TFTR Neutral Beams.

6225 **Progress in developing a volume D^- ion source.** Bacal, M.; Hillion, H. (Laboratoire de Physique des Milieux Ionises, Groupe de Recherche Nsf 29 du C.N.R.S., Ecole Polytechnique, Palaiseau). pp 1649-1653 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A hybrid multicusp plasma generator suitable for the volume production of H^- and D^- ion beams is presented. Extracted negative ion currents are compared to negative ion densities in the source plasma, as measured by the photodetachment technique.

6226 **Ion Source Protection Equipment for TFTR.** Segers, R.C. (Princeton Univ., Plasma Physics Lab., Princeton, NJ). pp 1638-1643 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

This paper is a follow up to the seminal papers of W. F. Praeg of Argonne National Labs. The saturable reactor described by Praeg in his papers is now in production for TFTR. In addition to these saturable reactors the Ion Source Protection Equipment includes a spark gap crowbar assembly which is coupled directly to the saturable reactor in the Neutral Beam's accelerating supply, and a signal coupled to the crowbar spark gap which serves as one of the earliest fault detection signals. A description of the design procedure for the Ion Source Protection Equipment is given first, followed by a detailed description of the development of the components for the production model.

6227 **Fabrication and testing of the flexible transmission line to the TFTR neutral beam ion sources.** Haughian, J.M.; Byrns, R.; Carrieri, J.; Fong, E.; Lou, K. (Lawrence Berkeley Lab.). pp 1629-1633 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The four Neutral Beam Injectors (NBI) on the TFTR Tokamak Test Cell (TTC) floor require twelve transmission lines to carry arc and filament power to the twelve ion sources from the basement. Also, the Neutral Beam Test Cell (NBTC) requires three lines but on the same floor through a wall. The same basic specifications apply: (1) center bundle operates at 120 kV with respect to the outer cables, (2) filament circuits at 6000 A, (3) arc circuits at 3000 A, (4) gradient grid, (5) accel grids in a quadrupole configuration, (6) multi wire control cable, (7) SF_6 environment, (7) flexible, (8) 36" centerline bend radius and (9) hi-pot to 200 kV.

6228 **A passive core snubber for spark protection of neutral beam injectors.** Fricke, K.G.; Braunsberger, U.; Ehringer, H.; Meixner, C.N.; Schwarz, U. (Institut fur Hochspannungstechnik, Technische Universitat Braunschweig PF 3329, D-3300 Braunschweig). pp 1621-1624 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The paper describes a simple snubber to be installed for protecting the neutral beam injectors of TEXTOR against damage from high voltage sparking. The snubber is a completely passive element as it needs no biasing. In order to prevent core saturation under all conditions, the passive snubber consists of iron cores with an air gap. Operating of this snubber is described in principle, results of a model experiment are presented, and a design example is given oriented at the expected power supply data of the TEXTOR neutral beam injectors.

6229 **TFTR centralized torus interface valve control system.** Pearson, G.G.; Olsen, D.H. (Princeton Univ., Plasma Physics Lab., Princeton, NJ). pp 1963-1964 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

A system developed especially for the TFTR to monitor and control the interface between the vacuum vessel and associated diagnostics will be described in this paper. Diagnostics which must be connected to the machine vacuum are required to do so through a Torus Interface Valve (TIV). Two types of TIV's are used on TFTR. The first type is a non-latching valve which must be held in the opened position by a sustained OPEN command, returning automatically to the closed position when the OPEN command is removed. This type of TIV is used on all systems which never insert a probe into the vacuum vessel through the TIV. The second type of TIV is a latching valve which requires a momentary OPEN command to open and a momentary CLOSE command to close. Each TIV is linked to its own dedicated logic controller. Each logic controller is hardwired to the appropriate TIV OPEN/CLOSED limit switches, probe IN/OUT limit switches, TFTR vacuum vessel pressure setpoint switches, and diagnostic pressure setpoint switches. The logic controller can be configured for local (push-button) or remote (computer) control. Each controller has a

uniquely coded keyswitch to determine the configuration. Whether under local or remote control, all OPEN and CLOSE commands must be approved by the TIV controller (TIVC). In the case of systems with probes, the controller must receive a positive indication that the probe is completely backed out before a CLOSE command will be transmitted from the TIVC to the TIV. Before a valve will be opened by a controller, the differential pressure across the valve must be within certain limits.

6230 **TFTR movable limiter instrumentation and controls.** Frankenberg, J.; Collins, D.; Kaufmann, D.; Mamoun, A. (Princeton Univ., Plasma Physics Laboratory, Princeton, NJ). pp 1579-1581 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The TFTR movable limiter is a single poloidal limiter located within one 18 /SUP o/ segment of the vacuum vessel. It consists of three (3) interconnected inconel backing plates covered with titanium carbide coated graphite tiles. The backing plates are positioned by three independent screw drive actuators. Cooling water is fed through the horizontal port cover to tubes brazed onto the backs of the backing plates. Thermocouples monitor the limiter temperature. (1) and more fully described in refs. (1) and (2). The positioning actuators are driven by independently controlled DC servo motors, controlled either locally or from CICADA. Drive motor shaft position is monitored by chain driven encoders and potentiometers. Limiter blade position can be varied to suit any plasma within the operating range. CICADA is programmed to keep the limiter stroke within safe operating limits. A microprocessor duplicates the CICADA protective function allowing limiter operation without CICADA. The potentiometer signal is sent to an analog computer, which safeguards the limiter against failure of the encoders or the micro-processor. Cooling water flows through the limiter in 3 separate paths, one for each blade. The flow rate and temperature rise through each loop are measured accurately to allow CICADA to calculate the heat into each blade. The water system is also interlocked and alarmed to prevent dumping of water into the vacuum vessel.

6231 **The testing of the Rectangular Pivot-point bellows for the PPPL Tokamak fusion test reactor.** Haughian, J.; Fong, M.; Greer, J.; Lou, K.; Scalise, D.T. (Lawrence Berkeley Laboratory, Univ. of California, Berkeley, CA). pp 1895-1900 of Fusion engineering. Vol. 2. New York, NY, USA; I.E.E.E. (1983). (CONF-831203—).

From 10. symposium on fusion engineering; Philadelphia, PA, USA (5 Dec 1983).

The Neutral Beam Pivot Point Bellows (PPB) is installed in the duct which connects the Neutral Beam Enclosure to the Torus. This bellows, located at the pivot point, must fit the severely limited space available at the pivot-point location. Consequently, it has to be made rectangular in cross section with a large inside area for beam access. This leads to small convolutions with high stress concentrations. The function of the bellows is to permit change in the angular positioning of the neutral beam line with respect to the Tokamak, to isolate the Neutral Beam Line from the deflection of the Torus during bake out, and to allow for all misalignments. Internally the bellows will have a vacuum along with such gases such as hydrogen or deuterium. Externally, air or nitrogen gas will be present. It is constructed of Inconel 718 convolutions welded together to provide a clear rectangular opening of 23.4 by 32.2 inches, joined to a 625 Inconel flange at each end.

99 GENERAL AND MISCELLANEOUS

6232 **(DOE/MA—0062/2) Department of Energy FY 1985 budget highlights.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Controller). Feb 1984. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85003087.

The FY 1985 budget request for the Department of Energy supports the Department's energy and national security missions in a strong and balanced manner. The budget for energy programs continues the Department's long standing commitment to support development of a mix of energy technologies which potentially can provide adequate supplies of energy at a reasonable cost. The Nation's energy security is enhanced through the continued development and fill of the Strategic Petroleum Reserve, and the Department continues to carry out its responsibilities as a principal sponsor of basic research into the fundamentals of matter by requesting a substantial increase in funding for general science research activities. Finally, the budget request meets the Department's responsibility to support the national security mission of the Department of Defense through the development, testing, and production of nuclear weapons and materials.

6233 **(ORAU—233-Vol.1) TRADE nontechnical training programs inventory. Volume I.** (Oak Ridge Associated Universities, Inc., TN (USA)). Oct 1984. Contract AC05-76OR00033. 112p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85003421.

In a continuing effort to facilitate communications and resource exchange among the DOE contractors, the TRADE (Training Resources and Data Exchange) Committee has compiled this volume. This inventory is one of four inventories, which taken together, total almost 1400 courses and reflect the range and focus of in-house training programs being offered throughout the DOE GOCO system by approximately 50 contractors.

6234 **(ORAU—234) TRADE (Training Resources and Data Exchange) nontechnical training programs inventory. Volume II.** (Oak Ridge Associated Universities, Inc., TN (USA)). Oct 1984. Contract AC05-76OR00033. 155p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85003437.

In a continuing effort to facilitate communications and resource exchange among the DOE contractors, the TRADE (Training Resources and Data Exchange) Committee has compiled this volume. This inventory is one of four inventories which, taken together, total almost 1400 courses and reflect the range and focus of in-house training programs being offered throughout the DOE GOCO system by approximately 50 contractors.

6235 **(ORAU/IEA—83-6(M)) Global population (1975-2075) and labor force (1975-2050).** Keyfitz, N.; Allen, E.; Edmonds, J.; Dougher, R.; Wiget, B. (Oak Ridge Associated Universities, Inc., TN (USA)). Apr 1983. Contract AC05-76OR00033. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85003088.

The Institute for Energy Analysis has developed projections of population to the year 2075 and of labor force to 2050. Projections are by country and aggregated to nine world regions. The Institute's work indicates great uncertainty surrounding world population forecasts, with best estimates of late 21st-century global population varying between 8 and 12 billion. The Institute finds the most compelling arguments support a lower number (8.2 billion by 2050 and 8.4 billion by 2075) with global population approaching stationarity. The population of labor force age is forecast to grow at a more rapid rate than total population. The most pronounced shift in the labor force ratio is expected in the developing nations, where the share of labor force age population is expected to reach 79% of the total in 2050 compared to 57% in 1975.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 9902004154, 4156, 4157, 4158, 4160, 4161, 4171, 4383, 4606, 4781, 5074, 5588

6236 **(CONF-8409176—1) Advanced concepts in systems analysis and simulation.** Berry, G. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85002728.

From 3. international conference on systems engineering; Dayton, OH, USA (5 Sep 1984).

Analysis and Simulation of Advanced Energy Systems are best investigated using a comprehensive systems code. This paper discusses the advanced concepts embodied in the SALT (Systems Analyses Language Translator) systems code. In particular, the concepts to be discussed are general system theory, preprocessing, precompilation of models, multidimensioned equation solving, optimization, dynamic systems and language translation. Some of the

specific methods of implementation included in the above concepts are, hierarchical decomposition, inverse calling, and polyalgorithmic optimization.

6237 (DOE/METC—84-10, pp 19-25) **1984 public version of ASPEN.** Williams, K.E. (EG and G WASC, Inc., Morgantown, WV). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—). Contract AC21-81MC14521.

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The public version of the Advanced System for Process Engineering (ASPEN) maintained by the Morgantown Energy Technology Center (METC) has undergone many changes since the release of the simulator by the National Energy Software Center (NESC) under the direction of DOE/METC. This report describes the changes made to the simulator at METC and outlines the rationale behind them. Major effort has been expended in the areas of graphics, simulation control, system configuration and installation, command executives, interactive simulation modification, costing and economic evaluation, and the use of electrolytes. The ASPEN documentation has been expanded to include nine help facilities, an automated problem/fix system, and completed documentation for the ASPEN system tables and bead structures. Effort is currently underway to provide complete on-line ASPEN manual documentation to facilitate the correction of errors and the addition of sections pertaining to the METC enhancements. Error control within ASPEN has also been improved, generating more descriptive diagnostics for error processing. A major effort has been directed to converting ASPEN to FORTRAN-77 and developing a machine independent version of ASPEN. This will facilitate the portability and the maintainability of the VAX and IBM versions of ASPEN distributed by NESC. 18 references.

6238 (DOE/METC—84-10, pp 26-35) **Process versus flowsheet simulation using ASPEN.** Stern, S.S.; Rinard, I.H.; Millman, M.C. (Scientific Design Co., New York, NY; Halcon SD Group, New York, NY; Halcon Computer Tech., New York, NY). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

The steady-state process simulation programs currently available commercially such as ASPEN, FLOWTRAN, PROCESS, and DESIGN 2000 are best used for flowsheet simulation. In this mode, a flowsheet case is run for one or more design specifications to generate the process heat and material balances. Individual items of equipment are then designed to obtain the flowsheet results. There are three other modes which are also of interest to process engineers, namely, optimization, rating and process simulation. Since few of the programs listed above have optimization capability, this mode is discussed only briefly. In the rating and process simlation mode, the equipment size parameters are specified. The program must calculate the performance of the process, generally for other than the full capacity operating conditions. ASPEN is weaker in the rating mode than in the flowsheet mode. These weaknesses are discussed and recommendations made for improving ASPEN's capabilities in this mode. Examples are given from the Great Plains ASPEN simulation study sponsored by DOE. This paper discusses the uses of ASPEN as a steady state simulator. The paper discusses material balance comparisons, equipment sizing and costing comparison, for alternate process configurations. This is far different from establishing equipment sizes for a controlling case and predicting the behavior of the plant with other feeds or at half capacity. 13 references, 2 figures.

6239 (DOE/METC—84-10, pp 57-68) **New capabilities in ASPEN PLUS.** Gallier, P.W.; Evans, L.B.; Boston, J.F.; Britt, H.I.; Chen, C.C. (Aspen Technology, Inc., Cambridge, MA). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

New developments in the ASPEN PLUS process simulator have produced a uniquely powerful simulation system. Recent completion of a two-year development program has resulted in new, state-of-the-art engineering capabilities, making ASPEN PLUS even more reliable, efficient, robust, and easy to use. Some of the major new ASPEN PLUS capabilities are reviewed in this paper, and examples are given. For petroleum processing, a completely new rigorous multi-column fractionator model is available. All of the complex operations normally found in crude oil distillation can be modeled, and properties of crude oil fractions and coal-derived liquid fractions may now be estimated readily. Another noteworthy advance is the ASPEN PLUS integrated electrolytes system that extends ASPEN PLUS modeling capabilities to environmental control processes as well as to many chemical and mineral processes. The electrolytes capability features aqueous and solids data banks contianing over 400 species, data regression of electrolytes systems, the ability to handle an apparent composition, the ability to model either strong or weak electrolytes, rigorous distillation with electrolytes, and data for many common systems. A sour water stripper design is discussed as an example. A number of other significant features greatly improve the efficiency and ease of use of ASPEN PLUS and the simulation productivity for the engineer. Complete access to physical property values, heating and cooling curves, improved stream and distillation reports, and many other enhancements all achieve a new level of power for process simulation. 22 references, 8 figures.

6240 (DOE/METC—84-10, pp 78-133) **Computer simulation of a split-flow Claus process.** Dyson, A.; Henry, J.M. (Tennessee Valley Authority, Chattanooga; Univ. of Tennessee, Chattanooga). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

This paper discusses the development of a steady state computer model for a typical Claus sulfur recovery process using the ASPEN process simulator to demonstrate how a process simulator to demonstrate how a process simulator may be used as an engineering tool for process and design evaluation. The goal of this work was to perform parametric and availability (second-law) analysis studies of a conceptual design sulfur recovery unit using the Claus process. The primary methodology used in data assembly for this work involves computer-aided process analysis and design. Heat and material balance data as well as process operating conditions are calculated by the ASPEN simulator based on specified input conditions. The primary conclusions of this work were that process simulation offers a consistent means of evaluating the expected performance of a process by studying off-design operating conditions before actual plant operations. In this work a Claus simulation model was developed to calculate detailed heat and material balances for process equipment. In addition, different feed stream compositions were input into the simulation model and sensitivity studies resulted. It was concluded that simulation programs can enhance engineers' awareness of corrective actions to be taken during process upsets. 32 references, 7 figures, 11 tables.

6241 (DOE/METC—84-10, pp 134-140) **Salt steady state systems code.** Berry, G.; Geyer, H. (Argonne National Lab., IL). Jun 1984. NTIS, PC A16/MF A01. File Number TI84003079. (CONF-831239—).

From Systems simulation symposium of fossil fuel conversion processes; Morgantown, WV, USA (6 Dec 1983).

A steady state system code has been developed at ANL and has been used to analyze or evaluate the following technologies: open cycle magnetohydrodynamics (MHD), liquid metal MHD, fuel cells, combined cycle coal gasification plants, pulverized coal fired power plants with flue gas desulfurization, pressurized and atmospheric fluidized bed combustion plants, municipal solid waste disposal systems, geothermal systems, fusion reactor coolant systems, nuclear power plants, and ocean thermal energy conversion power plants. The SALT systems code contains many unique and state-of-the-art features that have promoted its use in the many extensive systems. These features are: (1) a language translator, which allows free format and unsorted input; (2) a preprocessor, which allows great flexibility in defining a system and permitting the user to generate his own labels; (3) a state-of-the-art hybrid nonlinear N-dimensional equation solver that is extremely fast and robust (this algorithm has been incorporated in the latest version of the EPRI dynamic systems code [MMS] to find the steady-state solution; (4) a state-of-the-art optimizer; (5) a chemical-equilibrium subroutine for

calculating thermodynamic gas properties for specific chemical compositions; (6) off-design analysis capability; (7) economic modeling subroutines; (8) extensive use of splines for accurate and quick numerical evaluations (e.g., steam tables are represented by cubic splines); (9) precompiled models, so that only one set of generic instructions is loaded into core for each unique model type; (10) total modularity; and (11) compactness (an abridged version has fit on a 64K microprocessor).

6242 (Juel-Spez—255, pp 140) **Data acquisition and analysis.** Brinkmoeller, B.; Korthues, R.; Meissburger, J.; Paul, D. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6243 (Juel-Spez—255, pp 148) **Computer configurations.** Watzlawik, K.H.; Karnadi, M.; Nellen, R. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6244 (Juel-Spez—255, pp 148-149) **Off-line data evaluation.** Watzlawik, K.H.; Karnadi, M. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6245 (Juel-Spez—255, pp 149-150) **On-line processing and data acquisition.** Watzlawik, K.H.; Nellen, R.; Diesburg, H. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6246 (Juel-Spez—255, pp 150) **Software development.** Hoffmann, B. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6247 (Juel-Spez—255, pp 151) **Data analysis developments at JOSEF.** Lhersonneau, G.; Karnadi, M.; Tenten, W.; Seo, T. Apr 1984. NTIS (US Sales Only), PC A09/MF A01. File Number TI85750011.

In Kernforschungsanlage Juelich, Institut fuer Kernphysik: Annual report 1983.

6248 **(LA-UR—84-3139) Pattern selection and low-dimensional chaos in systems of coupled nonlinear oscillators.** Bishop, A. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 12p. (CONF-8408128—1). NTIS, PC A02. File Number DE85000659.

From Conference on dynamical problems in solition systems; Kyoto, Japan (27 Aug 1984).

The longtime behavior of a number of one- and two-dimensional driven, dissipative, dispersive, many-degree-of-freedom systems is studied. It is shown numerically that the attractors are characterized by strong mode-locking into a small number of (nonlinear) modes. On the basis of the observed profiles, estimates of chaotic attractor dimensions, and projections into nonlinear mode bases, it is argued that the same few modes may (in these extended systems) give a unified picture of spatial pattern selection, low-dimensional chaos, and coexisting coherence and chaos. Analytic approaches to this class of problem are summarized.

6249 **(PNL-SA—12330) Some data manipulation requirements for the exploratory analysis of large data sets.** Littlefield, R.J.; Cowley, P.J.; Whiting, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1984. Contract AC06-76RL01830. 5p. (CONF-8406139—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85002541.

From 9. international CODATA conference; Jerusalem, Israel (24 Jun 1984).

Exploratory data analysis is an iterative process in which the results of one analysis step suggest several new ways of viewing and further analyzing the data. The analyst may follow several different paths of inquiry during the course of the analysis. Each path may involve minor to major modifications to the data have different assumptions and produce its own intermediate results and displays. Several kinds of data management capabilities are required to support this sort of use. Because analysis is iterative, the analysis and data management tools must be integrated so that analysis results are preserved for subsequent use. Data of many different shapes and sizes must be stored. Efficient storage of multiple versions and subsets of data are needed to support multiple analysis paths. No single data management package provides all these capabilities, although various existing packages are identified that provide them individually. There is also a need for automatic tracking of analysis paths and steps. A new approach to data analysis management, using data analysis environments has been developed and is currently being implemented to meet these data manipulation requirements.

6250 **(UCRL—91689) Networking at LLNL.** Fletcher, J.G. (Lawrence Livermore National Lab., CA (USA)). 24 Oct 1984. Contract W-7405-ENG-48. 6p. (CONF-8410192—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003143.

From National Science Foundation sciencenet planning conference; Stanford, CA, USA (25 Oct 1984).

In addition to the preceding answers to the 13 questions that were posed, we would like to state here some of the principles and points of view that we (in our current state of understanding) believe lead to the best network design and that, therefore, characterize our design of LINCS. These may be regarded by some as unreasonably idealistic in that they take no notice of the limitations of generally available languages, operating systems, and communication protocols. However, we prefer to have a clear vision of where we would like to be, so that we choose properly among the compromises that we will have to make in practice in order to get there some time in the future.

6251 **(UILU-ENG—84-1729) Polylith and environments for mathematical computation.** Purtilo, J.M. (Illinois Univ., Urbana (USA). Dept. of Computer Science). May 1984. Contract AC02-76ER02383. 55p. (COO—2383-0098). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002967.

We first examine a rough paradigm for mathematical problem solving, a framework in which to develop requirements. Next, we discuss currently available tools and environments and evaluate how they do or do not support our problem solving paradigm. Following, then, is a requirements analysis, first of logical tools which we propose as components of our new environment and, second, of implementation tools necessary to bring about such an environment. As will be shown, a langauge (to be described) in which instances of environments may be specified is well motivated. We conclude, then, with a discussion on likely examples of environments which could be constructed using the proposed tools.

6252 **Vectorization of algorithms for solving systems of elliptic difference equations.** Buzbee, B.L. (Los Alamos National Laboratory, Los Alamos, NM). pp 81-88 of Impact of New Computing Systems on Computational Mechanics. Noor, A.K. New York, NY, USA; A.S.M.E. (1983). (CONF-831111—).

From ASME winter annual meeting; Boston, MA, USA (13 Nov 1983).

Today's fastest computers achieve their highest level of performance when processing vectors. Consequently, considerable effort has been spent in the past decade developing algorithms that can be expressed as operations on vectors. In this paper the authors define two types of vector architecture. They discuss the variation of performance that can occur on a vector processor as a function of algorithm and implementation, the consequences of this variation, and the performance of some basic operators on the two classes of vector architecture. They also discuss the performance of higher level operators, including some that should be used with caution. Using both basic and high level operators, they discuss vector implementation of techniques for solving systems of elliptic

difference equations. Included are fast Poisson solvers and point, line, and conjugate gradient techniques.

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Qualifier
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The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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1	*See* KURRI-TR-234	DE84703282	MN -80	10:4730
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Suppl.	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001480	MN -59b	10:4514
CONF-8209257-	(30. UKAEA diffraction analysis conference, Oxford, UK, 28-30 Sep 1982)			
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CONF-8210309-	(16. annual meeting of the Fachverband fuer Strahlenschutz e.V.: radiation protection, measurements and methods, Muniich, F.R. Germany, 19-22 Oct 1982)			
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CONF-821124-	(5. symposium on physics and technology of compact toroids in the magnetic fusion energy program, Bellevue, WA, USA, 16-18 Nov 1982)			
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	Nucl. Instrum. Methods Phys. Res., Sect. B, 230: No. 1-3, 422-426(Mar 1984)			10:5668
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	Nucl. Instrum. Methods Phys. Res., Sect. B, 230: No. 1-3, 516-519(Mar 1984)			10:5670
	Nucl. Instrum. Methods Phys. Res., Sect. B, 230: No. 1-3, 555-563(Mar 1984)			10:5671
	Nucl. Instrum. Methods Phys. Res., Sect. B, 230: No. 1-3, 19-24(Mar 1984)			10:5958
	Nucl. Instrum. Methods Phys. Res., Sect. B, 230: No. 1-3, 9-12(Mar 1984)			10:5981
CONF-8307133-	(13. intersociety conference on environmental systems, San Francisco, CA, USA, 11-13 Jul 1983)			
1	NTIS, PC A02; 3	DE84016510	MN -11	10:5301
CONF-8307142-	(Workshop on natural hazards research and applications, Boulder, CO, USA, 11 Jul 1983)			
1	*See* BNL-34370	DE85000879	MN -41	10:4711

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CONF-830803-	(3. international conference on numerical methods in laminar and turbulent flow, Seattle, WA, USA, 8-11 Aug 1983)			
10	*See* GKSS-83/E/80	DE84752282	MN -11	10:5399
CONF-8308137-	(CACGP symposium on trospospheric chemistry, Oxford, England, 28 Aug-3 Sep 1983)			
2	*See* BNL-34372	DE85003500	MN -11	10:5298
CONF-8308173-	(3. workshop on inner shell ionization by light ions, Linz, Austria, 4-5 Aug 1983)			
	Nucl. Instrum. Methods Phys. Res., Sect. B, 232: No. 2, 266-270(Jul 1984)			10:5664
	Nucl. Instrum. Methods Phys. Res., Sect. B, 232: No. 2, 271-278(Jul 1984)			10:5665
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
	J. Nucl. Mater., 122: No. 1-3, 252-253(May 1984)			10:4927
	J. Nucl. Mater., 122: No. 1-3, 552-557(May 1984)			10:4928
	J. Nucl. Mater., 122: No. 1-3, 91-95(May 1984)			10:4929
	J. Nucl. Mater., 122: No. 1-3, 850-854(May 1984)			10:4930
	J. Nucl. Mater., 122: No. 1-3, 196-200(May 1984)			10:4931
	J. Nucl. Mater., 122: No. 1-3, 214-218(May 1984)			10:4932
	J. Nucl. Mater., 122: No. 1-3, 224-229(May 1984)			10:4933
	J. Nucl. Mater., 122: No. 1-3, 260-265(May 1984)			10:4934
	J. Nucl. Mater., 122: No. 1-3, 402-406(May 1984)			10:4935
	J. Nucl. Mater., 122: No. 1-3, 427-428(May 1984)			10:4936
	J. Nucl. Mater., 122: No. 1-3, 37-50(May 1984)			10:6103
	J. Nucl. Mater., 122: No. 1-3, 51-65(May 1984)			10:6104
	J. Nucl. Mater., 122: No. 1-3, 66-79(May 1984)			10:6105
	J. Nucl. Mater., 122: No. 1-3, 827-832(May 1984)			10:6106
CONF-8309170-	(Symposium on the use of nonstandard subsized specimens for irradiated testing, Albuquerque, NM, USA, 23 Sep 1983)			
8	*See* HEDL-SA-2947-FP	DE85003011	MN -25	10:5077
CONF-8309280-	(Society of general physiology, Woods Hole, MA, USA, 11-14 Sep 1983)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85001111	MN -48	10:5439
CONF-8309283-	(International theoretical workshop on comets, Budapest, Hungary, 1 Sep 1983)			
1	*See* KFKI-1984-41	DE85700056	MN -34B	10:5632
CONF-831047-	(American Nuclear Society winter meeting, San Francisco, CA, USA, 30 Oct-4 Nov 1983)			
141	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002571	MN -70B	10:4356
CONF-831048-	(Global carbon cycle - analysis of the natural cycle and implications of anthropogenic alterations for the next century, Knoxville, TN, USA, 31 Oct-2 Nov 1983)			
4	NTIS, PC A04/MF A01 (GPO Dep.)	DE85002323	MN -11	10:5300
CONF-831063-	(American Institute of Chemical Engineers fall annual meeting, Washington, DC, USA, 30 Oct-3 Nov 1983)			
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002455	MN -70B	10:4357
CONF-831066-	(Electrochemical Society fall meeting, Washington, DC, USA, 9-14 Oct 1983)			
	Proc. - Electrochem. Soc., 84-1: 244-254(Oct 1983)			10:4770
	Proc. - Electrochem. Soc., 84-1: 413-421(Oct 1983)			10:4771
	Proc. - Electrochem. Soc., 84-1: 374-384(Oct 1983)			10:5054
CONF-8310167-	(NATO-AGARD lecture series number 131, Ankara, Turkey, 19-28 Oct 1983)			
4	*See* UCRL-88409	DE85001053	MN -38	10:4615
CONF-8310205-	(TMS-AIME fall meeting, Philadelphia, PA, USA, 2-6 Oct 1983)			
12	*See* PNL-SA-11270	DE85003112	MN -25	10:4918
CONF-8310319-	(IVA symposium on rational use of electricity and electric power generation, Stockholm, Sweden, 28 Oct 1983)			
	See IVA-259	DE85750228	MN -13	10:4803
CONF-8310337-	(Conference on early stages of decomposition of alloys, Crete, Greece, 17-21 Oct 1983)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002321	MN -25	10:4895
CONF-8310338-	(Mag-U-Comp conference, Milwaukee, WI, USA, 28 Oct 1983)			
1	NTIS, PC A03; 3	DE85003040	MN -28	10:5131
CONF-8310340-	(ASM materials science seminar on flow and fracture at elevated temperature, Philadelphia, PA, USA, 1-2 Oct 1983)			
1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000971	MN -25	10:4896
CONF-8311207-	(Symposium on roadway drivage techniques in the coal mines of the European Community, Luxembourg, Luxembourg, 9-10 Nov 1983)			
	See EUR-9126-d,e,f			10:4236
CONF-831203-	(10. symposium on fusion engineering, Philadelphia, PA, USA, 5-9 Dec 1983)			
187	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002569	MN -20b	10:6077
188	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002573	MN -20b	10:6078

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190 CONF-831239-	NTIS, PC A02/MF A01; 1 (GPO Dep.) (Systems simulation symposium of fossil fuel conversion processes, Morgantown, WV, USA, 6-8 Dec 1983)	DE85002558	MN -20	10:6079
CONF-831273-	*See* DOE/METC-84-10 (Royal Swedish Academy of Engineering Sciences energy storage conference, Stockholm, Sweden, 12 Dec 1983)	DE84003079	STD -90	10:4153
CONF-831298-	*See* IVA-261 (Bureau of Mines technology transfer seminar on mine ground control, Pittsburgh, PA, USA, 6-7 Dec 1983)	DE85750227	MN -94	10:4804
CONF-831299-	*See* BM-IC-8973 (Bureau of Mines technology transfer seminar on mine ground control, Denver, CO, USA, 8-9 Dec 1983)	TI85900281	MN -88	10:4216
CONF-8312101-	*See* BM-IC-8973 (Annual meeting of the Academy of International Business, San Francisco, CA, USA, 27-30 Dec 1983)	TI85900281	MN -88	10:4216
1 CONF-840180-	NTIS (US Sales Only), PC A03/MF A01; 1 (2. annual review meeting of the National Acid Precipitation Assessment Program, Frederick, MD, USA, 31 Jan-1 Feb 1984)	DE85900278	MN -98B	10:4287
Summ. CONF-840181-	NTIS, PC A05/MF A01 (GPO Dep.) (American Geophysical Union Monography meeting on carbon dioxide through geologic time, Tarpon Spring, FL, USA, 15 Jan 1984)	DE85003003	MN -11	10:4786
1 CONF-8403121-	NTIS, PC A03/MF A01 (GPO Dep.) (New particle production at high energy meeting: The Recontre de Moriond, La Plagne, France, 4-10 Mar 1984)	DE85000979	MN -11	10:5356
8	*See* DESY-84-029	DE84752267	ND -34D	10:5702
9 CONF-8403122-	*See* RAL-84-033 (4. general CMD conference of the condensed matter division of the European Physical Society, Hague, Netherlands, 19-22 Mar 1984)	DE84703353	MN -34D	10:5731
2 CONF-8403146-	*See* RAL-84-015 (IEA workshop on latent heat stores, Stuttgart, F.R. Germany, 5-9 Mar 1984)	DE84703270	MN -28	10:5170
5 CONF-8403150-	NTIS, PC A02/MF A01 (GPO Dep.) (DOE-OHER workshop on monitoring and dosimetry in an occupational health research program for synfuel technologies, Knoxville, TN, USA, 20-22 Mar 1984)	DE85001097	MN -59b	10:4581
3 CONF-840413-	NTIS, PC A02/MF A01 (GPO Dep.) (Topical meeting on robotics and remote handling in hostile environments, Gatlinburg, TN, USA, 23-26 Apr 1984)	DE85002299	MN -41	10:5302
13-Draft CONF-840440-	NTIS, PC A02/MF A01 (GPO Dep.) (86. annual meeting and exposition of the American Ceramic Society, Pittsburgh, PA, USA, 29 Apr-3 May 1984)	DE85002572	MN -86	10:4340
8 CONF-8404163-	*See* HEDL-SA-2853-FP (6. international conference on high energy physics, Nashville, TN, USA, 6-8 Apr 1984)	DE85003000	MN -25	10:4338
3 CONF-8404198-	*See* BNL-35183 (ASTM committee week meeting, Jacksonville, FL, USA, 8-13 Apr 1984)	DE85000587	MN -34D	10:5677
1 CONF-8404202-	*See* GKSS-84/E/26 (OHER workshop on occupational health and research, Germantown, MD, USA, 26 Apr 1984)	DE85750264	MN -25	10:4899
1 CONF-840512-	NTIS, PC A02/MF A01 (GPO Dep.) (6. congress of the International Radiation Protection Association, Berlin, F.R. Germany, 7-12 May 1984)	DE85001121	MN -41	10:5538
19 CONF-840568-	*See* PNL-SA-11785 (Pacific Northwest bioenergy systems policies and applications seminar, Portland, OR, USA, 10-11 May 1984)	DE85003111	MN -41	10:5516
CONF-8405153-	NTIS, PC A14/MF A01; 1 (GPO Dep.) (Horizontal-axis wind turbine technology conference, Cleveland, OH, USA, 8-10 May 1984)	DE85001416	MN -61d	10:4807
4 CONF-8405193-	*See* SERI/TP-214-2374 (Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984)	DE84013012	MN -60	10:4600
47 CONF-8405216-	*See* TRI-PP-84-47 (AAPG annual convention, San Antonio, TX, USA, 20-23 May 1984)	DE85900225	MN -34D	10:5140
	Am. Assoc. Pet. Geol., Bull., 68: No. 4, 524(Apr 1984)			10:4279
	Am. Assoc. Pet. Geol., Bull., 68: No. 4, 534(Apr 1984)			10:4304

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CONF-8405241-	(Seminar on perspectives for experimental apparatus at future high energy machines, Florence, Italy, 21-25 May 1984)			
1	*See* MPI-PAE/Exp.El.-130	DE85750009	MN -37	10:5261
CONF-840604-	(12. international symposium on effects of radiation on materials, Williamsburg, VA, USA, 18-20 Jun 1984)			
28	*See* HEDL-SA-3038	DE85003012	MN -25	10:4699
29	*See* HEDL-SA-3037-FP	DE85003019	MN -25	10:4907
CONF-840647-	(ASME pressure vessel and piping conference, San Antonio, TX, USA, 17-21 Jun 1984)			
	Am. Soc. Mech. Eng., [Pap.], 84-PVP-122: 6(Jun 1984)			10:4625
	Am. Soc. Mech. Eng., [Pap.], 84-PVP-5: 6(Jun 1984)			10:4660
	Am. Soc. Mech. Eng., [Pap.], 84-PVP-40: 9(Jun 1984)			10:4661
	Am. Soc. Mech. Eng., [Pap.], 84-PVP-19: 8(Jun 1984)			10:4662
	Am. Soc. Mech. Eng., [Pap.], 84-PVP-41: 5(Jun 1984)			10:4663
30	*See* PNL-SA-12038	DE85000832	MN -80	10:4745
CONF-8406118-	(7. international conference of women engineers and scientists, Washington, DC, USA, 17-24 Jun 1984)			
6	*See* N-84-25017			10:4867
CONF-8406124-	(2. workshop on containment integrity, Crystal City, VA, USA, 13-15 Jun 1984) .			
13	*See* BNL-NUREG-35286	TI85000892	MN -78	10:4713
14	*See* BNL-NUREG-35285	TI85000877	MN -78	10:4963
CONF-8406139-	(9. international CODATA conference, Jerusalem, Israel, 24-28 Jun 1984)			
7	*See* PNL-SA-12330	DE85002541	MN -32	10:6249
CONF-8406152-	(CRDC scientific conference on obscuration and aerosol research, Baltimore, MD, USA, 25-29 Jun 1984)			
2	*See* LA-UR-84-3057	DE85002051	MN -32	10:5994
CONF-8406153-	(7. international conference on spectral line shapes, Aussois, France, 11-15 Jun 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001504	MN -20	10:6026
CONF-8406183-	(15. international symposium on multiparticle dynamics, Lund, Sweden, 11-16 Jun 1984)			
4	*See* BNL-35277	DE85000237	MN -34D	10:5678
CONF-8406189-	(4. international conference on ultrarelativistic nucleus-nucleus collisions - QUARK MATTER '84, Helsinki, Finland, 17-24 Jun 1984)			
2	*See* LA-UR-84-2733	DE84016776	MN -34D	10:5726
CONF-8406198-	(Design and utilization of the superconducting super collider summer study, Snowmass, CO, USA, 23 Jun-13 Jul 1984)			
20	*See* ANL-HEP-CP-84-67	DE85003041	MN -28	10:5142
CONF-8406212-	(International school of physics "Enrico Fermi", Varenna, Italy, 18-22 Jun 1984)			
2	*See* LBL-18406	DE85001649	MN -34D	10:5766
CONF-8406214-	(European two-phase flow group meeting, Rome, Italy, 18-21 Jun 1984)			
1	*See* GKSS-84/E/24	DE85750263	MN -38	10:5094
CONF-8406219-	(Annual DOE adhesives symposium, Kansas City, MO, USA, 19-20 Jun 1984)			
1	*See* UCRL-90603	DE85001210	MN -45	10:5285
CONF-840738-	(Progress in quantitative NDE, San Diego, CA, USA, 8-13 Jul 1984)			
9	*See* IS-M-527	DE85003080	MN -25	10:4911
10	*See* IS-M-526	DE85003068	MN -34	10:5105
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)			
15	*See* SLAC-PUB-3446	DE85001941	MN -34D	10:5696
17	*See* DOE/ER/40033-66	DE85001827	MN -34D	10:5681
18	*See* DOE/ER/40033-65	DE85001832	MN -34D	10:5680
20	*See* SLAC-PUB-3440	DE85002717	MN -34D	10:5735
21	*See* ANL-HEP-CP-84-66	DE85002544	MN -34D	10:5676
22	*See* SLAC-PUB-3406	DE84017639	MN -34D	10:5734
CONF-840795-	(7. European symposium on antiproton interactions, Durham, UK, 9-13 Jul 1984)			
3	*See* LA-UR-84-2819	DE85002019	MN -34C	10:5837
CONF-840802-	(ANS International topical meeting on fuel reprocessing and waste management, Jackson Hole, WY, USA, 26-29 Aug 1984)			
25	*See* PNL-SA-12283	DE85002539	MN -70	10:4379
CONF-840804-	(Intersociety energy conversion engineering conference, San Francisco, CA, USA, 19-24 Aug 1984)			
36	NTIS, PC A02; 3	DE84016603	MN -77	10:4714
53	*See* DOE/NASA/20320-60	DE85003043	STD -60	10:4592
CONF-840819-	(Doing better: setting an agenda for the second decade, Santa Cruz, CA, USA, 14-22 Aug 1984)			
14	*See* PNL-SA-12135	DE85003104	MN -95d	10:4840

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CONF-840829-	(International conference on x-ray and inner-shell processes in atoms, molecules and solids, Leipzig, Germany D.R., 20-24 Aug 1984)			
4	*See* PNL-SA-12212	DE85003107	MN -34A	10:5652
CONF-840872-	(SPIE annual technical symposium, San Diego, CA, USA, 19-24 Aug 1984)			
31	*See* SERI/TP-255-2454	DE85000512	STD -59b	10:4843
32	*See* SERI/TP-255-2455	DE85000513	STD -59b	10:4547
CONF-840891-	(Symposium on concrete pressure and storage vessels, Calgary, Alberta, Canada, 25-31 Aug 1984)			
1	NTIS, PC A02; 3	DE84016561	MN -80	10:4639
CONF-8408125-	(American Society of Engineering Management national meeting, Dallas, TX, USA, 20 Aug 1984)			
1	*See* K/D-5590	DE85002072	MN -38	10:4781
CONF-8408126-	(American Phychological Association meeting, Toronto, Canada, 24-28 Aug 1984)			
1	*See* PNL-SA-12397	DE85000367	MN -80	10:4746
CONF-8408128-	(Conference on dynamical problems in solition systems, Kyoto, Japan, 27-31 Aug 1984)			
1	*See* LA-UR-84-3139	DE85000659	MN -32	10:6248
CONF-840901-	(ANS topical meeting on reactor physics and shielding, Chicago, IL, USA, 17-19 Sep 1984)			
20	*See* HEDL-SA-3108-FP	DE85001065	MN -79m	10:4700
CONF-840902-	(5. ASTM-Euratom symposium on reactor dosimetry, Geesthacht, F.R. Germany, 24-28 Sep 1984)			
14	*See* HEDL-SA-3098-FP	DE85001060	MN -78	10:4630
CONF-840915-	(13. symposium on fusion technology, Varese, Italy, 24-28 Sep 1984)			
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002531	MN -20	10:6080
CONF-840937-	(Applied superconductivity conference, San Diego, CA, USA, 9-13 Sep 1984)			
16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002486	MN -20	10:6081
19	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002545	MN -28	10:5124
20	*See* LBL-17634	DE85001654	MN -28	10:5138
CONF-840945-	(Topical conference on neutron-nucleus collisions--a probe of nuclear structure, Glouster, OH, USA, 5-8 Sep 1984)			
10	*See* UCRL-91421	DE85003200	MN -34C	10:5944
CONF-840954-	(9. national passive solar conference, Columbus, OH, USA, 23-27 Sep 1984)			
8	*See* LBL-18247	DE85000619	MN -59b	10:4830
9	*See* SERI/TP-253-2476	DE85000527	MN -59b	10:4546
10	*See* SERI/TP-253-2461	DE85000526	MN -59b	10:4841
CONF-840963-	(DOE and DOE contractors' occupational safety and health conference, San Diego, CA, USA, 11-13 Sep 1984)			
2	*See* HEDL-SA-3198-FP	DE85001063	MN -41	10:5560
4	*See* HEDL-SA-3193-FP	DE85001427	MN -41	10:5559
CONF-8409102-	(EPS topical conference on electronic structure and properties of rare earth and actinide intermetallics, St. Polten, Austria, 3-6 Sep 1984)			
6	NTIS, PC A04; 3	DE85002543	MN -25	10:4897
CONF-8409115-	(6. annual Low-Level Waste Management Program participants' information meeting, Denver, CO, USA, 11-13 Sep 1984)			
12	*See* PNL-SA-12538	DE85002525	MN -70B	10:4396
CONF-8409118-	(Passive and hybrid solar energy update, Washington, DC, USA, 5-7 Sep 1984)			
6	*See* SERI/TP-253-2485	DE84013044	MN -59b	10:4842
7	*See* SERI/TP-253-2465	TI84013041	MN -59b	10:4545
CONF-8409127-	(6. international colloquium on the optimization of plant nutrition, Montpellier, France, 2-8 Sep 1984)			
3	*See* LA-UR-84-2569	DE84016748	MN -11	10:5358
CONF-8409133-	(American Society for Engineering Management meeting, Dallas, TX, USA, 23-25 Sep 1984)			
1	*See* K/TS-5360	DE84016809	MN -22	10:4330
CONF-8409161-	(5. symposium on neutron dosimetry, Munich, F.R. Germany, 17-21 Sep 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001250	MN -48	10:5478
CONF-8409162-	(6. international symposium on high energy spin physics, Marseille, France, 12-19 Sep 1984)			
2	*See* DOE/ER/40108-2	DE85000017	MN -34D	10:5747
3	*See* LA-UR-84-3378	DE85002420	MN -34C	10:5809
CONF-8409163-	(Workshop on coherent and collective properties of relativistic E-beams and electromagnetic radiation, Villa Olmo, Como, Italy, 13-16 Sep 1984)			
2	*See* UCRL-91476	DE85003141	MN -21	10:5089
CONF-8409167-	(Joint Nordic Council for Research Policy and International Institute for Applied Systems Analysis symposium on applied mathematics, systems, Geilo, Norway, 17-20 Sep 1984)			
1	*See* LA-UR-84-3396	DE85002417	MN -48	10:5433

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CONF-8409168-	(American Wind Energy Association conference, Pasadena, CA, USA, 24-26 Sep 1984)			
1	*See* SAND-84-2017C	DE85002445	MN -60	10:4599
CONF-8409169-	(Society for Risk Analysis annual meeting, Knoxville, TN, USA, 30 Sep-3 Oct 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002580	MN -48	10:5539
CONF-8409172-	(International symposium on iteration theory and its functional equations, Lochau, Austria, 27 Sep-2 Oct 1984)			
1	*See* LA-UR-84-3089	DE85000655	MN -32	10:6012
CONF-8409175-	(Washington conference on fuel ethanol, Washington, DC, USA, 13 Sep 1984)			
1	*See* SERI/TP-231-2483	DE85000506	STD -61a	10:4811
CONF-8409176-	(3. international conference on systems engineering, Dayton, OH, USA, 5-7 Sep 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002728	MN -32	10:6236
CONF-8409177-	(Performance of borosilicate glass HLW forms in disposal systems workshop, Germantown, MD, USA, 18-19 Sep 1984)			
1	*See* UCRL-91631	DE85003201	MN -4	10:4384
CONF-8409178-	(Conference on large scale fire phenomenology, Gaithersburg, MD, USA, 10-13 Sep 1984)			
1	*See* UCRL-91268	DE85003140	MN -11	10:5293
CONF-8409179-	(American Institute of Mining, Metallurgical and Petroleum Engineers conference, Detroit, MI, USA, 17-21 Sep 1984)			
2	*See* IS-M-519	DE85002678	MN -25	10:4952
3	*See* IS-M-521	DE85002681	MN -25	10:4910
4	*See* IS-M-520	DE85002677	MN -25	10:4909
CONF-841007-	(Nuclear science symposium, Orlando, FL, USA, 31 Oct-2 Nov 1984)			
9	*See* LA-UR-84-3304	DE85002383	MN -37	10:5257
11	*See* LA-UR-84-3389	DE85002378	MN -37	10:5259
17	*See* LA-UR-84-3305	DE85002382	MN -37	10:5258
18	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002737	MN -79p	10:4684
23	*See* SLAC-PUB-3464	DE85002686	MN -28	10:5267
24	NTIS, PC A02; 3	DE85002593	MN -37	10:5205
25	*See* SLAC-PUB-3462	DE85002685	MN -28	10:5266
26	*See* SLAC-PUB-3468	DE85002687	MN -28	10:5268
27	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003035	MN -34C	10:5143
CONF-841010-	(Meeting of the Plasma Physics Division of the American Physical Society, Boston, MA, USA, 27 Oct-3 Nov 1984)			
1	*See* DOE/DP/40124-47	DE85002820	MN -21	10:6083
2	*See* DOE/DP/40124-60	DE85002819	MN -21	10:6088
3	*See* DOE/DP/40124-49	DE85002816	MN -21	10:6085
4	*See* DOE/DP/40124-71	DE85002817	MN -21	10:6027
5	*See* SAND-84-1423C	DE85002639	MN -28	10:5139
6	*See* DOE/DP/40124-54	DE85002814	MN -21	10:6087
7	*See* DOE/DP/40124-62	DE85002812	MN -21	10:6089
8	*See* DOE/DP/40124-48	DE85002821	MN -21	10:6084
10	*See* DOE/DP/40124-51	DE85002813	MN -21	10:6086
CONF-841013-	(Seminar on remote handling equipment for nuclear fuel cycle facilities, Harwell, Oxfordshire, UK, 2-5 Oct 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002556	MN -83	10:4341
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002458	MN -83	10:4342
CONF-841017-	(Specialists' meeting on reactor noise - SMORN IV, Dijon, France, 15-19 Oct 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002474	MN -78	10:4627
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002473	MN -79	10:4696
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002317	MN -78	10:4628
CONF-841023-	(27. ORNL-DOE conference on analytical chemistry in energy technology, Knoxville, TN, USA, 2-4 Oct 1984)			
4	*See* DP-MS-84-55	DE85002828	MN -80	10:4404
CONF-841041-	(23. Hanford Life Sciences symposium--interaction of biological systems with static and ELF electric and magnetic fields, Richland, WA, USA, 2-4 Oct 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002579	MN -41	10:5549
CONF-841075-	(International thermal hydraulics and plant operations topical meeting, Taipei, Taiwan, 22-24 Oct 1984)			
3	*See* BNL-NUREG-35195	TI85000573	MN -78	10:4712
CONF-841077-	(Statistics symposium on national energy issues, Seattle, WA, USA, 16-18 Oct 1984)			
2	*See* PNL-SA-12466	DE85002536	MN -41	10:5517
CONF-841094-	(International workshop on irradiated fuel storage--operating experience and development programs, Toronto, Ontario, Canada, 17-18 Oct 1984)			
1	*See* PNL-SA-12576	DE85003115	MN -85	10:4354
CONF-841096-	(Colloquium on community energy management as an economic development strategy, Lincoln, NE, USA, 14-16 Oct 1984)			
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002550	MN -95	10:4858

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
CONF-841099-	(Human Factors Society annual meeting, San Antonio, TX, USA, 22-26 Oct 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002479	MN -80	10:4672
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002478	MN -86	10:4343
CONF-8410142-	(12. water reactor safety research information meeting, Gaithersburg, MD, USA, 23-26 Oct 1984)			
3	*See* SAND-84-1627C	DE84016780	MN -80	10:4747
5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000268	MN -78	10:4717
9	*See* SAND-84-1801C	DE85000771	MN -78	10:4750
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001670	MN -78	10:4718
12	*See* UCRL-91681	DE85000851	MN -78	10:4756
15	*See* SAND-84-1764C	DE85002441	MN -78	10:4748
16	*See* SAND-84-1768C	DE85002446	MN -78	10:4749
22	*See* LA-UR-84-3317	DE85002390	MN -78	10:4733
23	*See* LA-UR-84-3316	DE85002380	MN -78	10:4732
24	*See* LA-UR-84-3315	DE85002381	MN -78	10:4731
26	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002500	MN -78	10:4697
28	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002592	MN -78	10:4898
29	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002466	MN -78	10:4719
32	*See* SAND-84-2076C	DE85002643	MN -78	10:4753
33	*See* SAND-84-2077C	DE85002641	MN -78	10:4754
CONF-8410147-	(Radiobiology of radium and thorotrast conference, Neuherberg, F.R. Germany, 29-31 Oct 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002761	MN -48	10:5479
CONF-8410172-	(Symposium of northeastern accelerator personnel, Stony Brook, NY, USA, 15-18 Oct 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002741	MN -28	10:5144
4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002740	MN -28	10:5125
CONF-8410173-	(International meeting on reduced enrichment for research and test reactors, Argonne, IL, USA, 14-18 Oct 1984)			
1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000172	MN -80	10:4698
CONF-8410176-	(2. international congress on automation, Barcelona, Spain, 15-18 Oct 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002465	MN -4	10:5540
CONF-8410181-	(Long-term ecological processes in forested waterbeds conference, Athens, GA, USA, 15-17 Oct 1984)			
1	*See* DP-MS-84-113	DE85002822	MN -11	10:5357
CONF-8410182-	(Commission for the scientific exploration of the Mediterranean Sea, Lucerne, Switzerland, 9-20 Oct 1984)			
1	*See* SAND-84-2060C	DE85002624	MN -70	10:4382
CONF-8410185-	(New York Academy of Sciences conference on membrane transport drive by ion gradients, New York, NY, USA, 2-4 Oct 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002563	MN -48	10:5440
CONF-8410186-	(Symposium on optical materials for high power lasers, Boulder, CO, USA, 15-17 Oct 1984)			
1	*See* PNL-SA-12594	DE85003118	MN -34A	10:5088
2	*See* PNL-SA-12573	DE85003116	MN -34A	10:4970
CONF-8410189-	(10. MPA seminar on safety of light water reactor pressure vessels, Stuttgart, F.R. Germany, 11-12 Oct 1984)			
1	*See* PNL-SA-12475	DE85003117	MN -78	10:4680
CONF-8410190-	(Annual meeting of the Society for Risk Analysis, Knoxville, TN, USA, 1-3 Oct 1984)			
1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002727	MN -11	10:4267
CONF-8410191-	(NSF/JSPS workshop, Bozeman, MT, USA, 15-17 Oct 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003025	MN -90g	10:4812
2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002749	MN -90g	10:4813
CONF-8410192-	(National Science Foundation sciencenet planning conference, Stanford, CA, USA, 25-26 Oct 1984)			
1	*See* UCRL-91689	DE85003143	MN -32	10:6250
CONF-841105-	(Joint meeting of the American Nuclear Society and the Atomic Industrial Forum, Washington, DC, USA, 11-16 Nov 1984)			
4	NTIS, PC A02; 3	DE84014765	MN -79	10:4715
22-Summ.	NTIS, PC A02; 3	DE84014723	MN -80	10:4716
36	*See* DP-MS-84-53	DE85002826	MN -80	10:4675
38	*See* HEDL-SA-3156-FP	DE85003010	MN -79b	10:4653
40	*See* HEDL-SA-3218-FP	DE85002998	MN -79k	10:4654
41	*See* HEDL-SA-3159-FP	DE85003013	MN -79e	10:4701
CONF-841117-	(8. conference on the application of accelerators in research and industry, Denton, TX, USA, 12-14 Nov 1984)			
17	*See* UCRL-91041	DE85003138	MN -28	10:5172
18	*See* UCRL-91040	DE85003137	MN -28	10:5128
19	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003064	MN -34A	10:5646
20	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003083	MN -34A	10:5647
CONF-841120-	(Workshop on corrosion performance of nuclear fuel waste containers, Ottawa, Canada, 21-22 Nov 1984)			
1	*See* SAND-83-2372C	DE84006292	MN -70	10:4919

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CONF-841155-	(1. joint symposium on dry SO/sub 2/ and simultaneous SO/sub 2//NO/sub x/ control technologies, San Diego, CA, USA, 13-16 Nov 1984)			
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002521	MN -90a	10:4198
2	*See* DOE/FE/60181-84	DE85002495	MN -90i	10:4199
CONF-841157-	(Symposium on the scientific basis for nuclear waste management, Boston, MA, USA, 26-29 Nov 1984)			
13	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002730	MN -70	10:5602
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002547	MN -70	10:4358
15	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002750	MN -70	10:4391
16	NTIS, PC A02; 3	DE85002772	MN -70	10:4964
17	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002745	MN -70	10:4392
18	NTIS, PC A02; 3	DE85001841	MN -70	10:4965
CONF-841164-	(International symposium on LMFBR development, Tokyo, Japan, 6-9 Nov 1984)			
1	*See* HEDL-SA-3226	DE85002997	MN -79h	10:4655
CONF-841174-	(5. information exchange meeting on debris coolability, Los Angeles, CA, USA, 7-9 Nov 1984)			
6	*See* SAND-84-1837C	DE84017005	MN -78	10:4751
CONF-841184-	(Magnetism and magnetic materials conference and exhibit, San Diego, CA, USA, 27-30 Nov 1984)			
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002532	MN -25	10:4889
7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001840	MN -25	10:4890
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003037	MN -34A	10:4951
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003036	MN -34A	10:4891
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003039	MN -25	10:4892
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003038	MN -25	10:4966
12	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003022	MN -34	10:4967
CONF-841187-	(5. DOE environmental protection information meeting, Albuquerque, NM, USA, 6-8 Nov 1984)			
5	*See* DP-MS-84-47	DE85002829	MN -70B	10:4365
6	*See* Y/DZ-119	DE85002619	MN -69	10:5393
CONF-8411112-	(IMOG CAD/CAM factory management seminar, Miamisburg, OH, USA, 8 Nov 1984)			
1	*See* SAND-84-2208C	DE85000415	MN -38	10:5079
CONF-8411114-	(Association of System 2000 users for technology exchange, Hilton Head, SC, USA, 12 Nov 1984)			
1	*See* SAND-84-1979C	DE85000769	MN -80	10:4752
CONF-8411117-	(12. midwest solid state theory symposium, Minneapolis, MN, USA, 29-30 Nov 1984)			
1	*See* IS-M-523	DE85003066	MN -34	10:5978
CONF-841201-	(ASME winter annual meeting, New Orleans, LA, USA, 9-13 Dec 1984)			
17	*See* SERI/TP-252-2337	DE84013026	STD -62	10:4509
19	*See* UCRL-91741	DE85003591	MN -92	10:4310
CONF-841218-	(31. national vacuum symposium, Reno, NV, USA, 3-7 Dec 1984)			
5	*See* SAND-82-2393C	DE85002633	MN -20	10:6101
CONF-841246-	(1. international conference on fusion reactor materials, Tokyo, Japan, 3-6 Dec 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002771	MN -20c	10:4893
3	*See* HEDL-SA-3177-FP	DE85003015	MN -20e	10:6097
4	*See* HEDL-SA-3152-FP	DE85003014	MN -20c	10:4908
5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001817	MN -20c	10:6082
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002775	MN -20c	10:4894
CONF-850118-	(3. international modal analysis conference, Orlando, FL, USA, 28-31 Jan 1985)			
5	*See* SAND-84-0985C	DE85000467	MN -22	10:4331
COO-				
2383-0098	*See* UILU-ENG-84-1729	DE85002967	MN -32	10:6251
12003-6	*See* DOE/ER/12003-6	DE85003222	MN -48	10:5429
CSIR-K-				
62	NTIS (US Sales Only), PC A03/MF A01	DE84703240	MN -4	10:4979
CSIR-RR-				
394	NTIS (US Sales Only), PC A03/MF A01	DE84703241	MN -4	10:4980
575	NTIS (US Sales Only), PC A03/MF A01	DE84703242	MN -4	10:4981
602	NTIS (US Sales Only), PC A03/MF A01	DE84703243	MN -4	10:4982
603	NTIS (US Sales Only), PC A03/MF A01	DE84703244	MN -4	10:4983
CSIR-SR-FIS-				
290	NTIS (US Sales Only), PC A10/MF A01	DE84703312	MN -2	10:5623
320	NTIS (US Sales Only), PC A06/MF A01	DE84703313	MN -2	10:5565
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103-15A	*See* PB-84-242569			10:5392
103-15B	*See* PB-84-242577			10:5322
103-16A	*See* PB-84-243179			10:5324
103-20	*See* PB-84-241637			10:5318
144-20	*See* PB-84-243039			10:5323
CTA-IEAV-NT-				
07/ 84	NTIS (US Sales Only), PC A03/MF A01	DE85700184	MN -34C	10:5845
007/ 83	NTIS (US Sales Only), PC A03/MF A01	DE85780223	MN -32	10:5949
CTA-IEAV-RP-				
009/ 83	NTIS (US Sales Only), PC A02/MF A01	DE85700153	MN -34D	10:5752
DESY-				
84-029	NTIS (US Sales Only), PC A02/MF A01	DE84752267	ND -34D	10:5702

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DESY-L-Trans-290	NTIS (US Sales Only), PC A03/MF A01	DE85750018	MN -34D	10:5174
DFVLR-FB-83-41	*See* N-84-25039			10:5086
84-03-PT-1	*See* N-84-25170			10:4766
84-22	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750262	MN -38	10:5091
DGMK-285	Deutsche Gesellschaft fuer Mineraloelwissenschaft und Kohlechemie e.V., Hamburg (Germany, F.R.)			10:4863
DOE/AL/13126-T1	NTIS, PC A09; 3	DE85001795	MN -70B	10:4359
DOE/BP-261	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001852	MN -95	10:4859
328	NTIS, PC A05; 3	DE85000485	MN -95d	10:4825
DOE/BPO-84/ 2	NTIS, PC A05/MF A01 (GPO Dep.)	DE84012728	STD -92a	10:4281
DOE/CE/30718-T1	NTIS, PC A11/MF A01; 1	DE84015467	STD -64	10:4512
DOE/CE/30740-1	NTIS, PC A05; 3	DE85002183	MN -59b	10:4515
DOE/CE/30784-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85003095	MN -61a	10:4450
DOE/CE/50036-T8	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001208	MN -96	10:4864
DOE/CS/30370-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000180	MN -59b	10:4516
DOE/CS/30467-T7	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85001533	MN -58c	10:4446
DOE/CS/30528-T1	NTIS, PC A03; 3	DE84011781	MN -59b	10:4826
DOE/CS/30634-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002894	MN -59b	10:4440
DOE/CS/40074-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002600	MN -95f	10:4827
DOE/CS/54262-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002889	MN -96	10:4845
DOE/CS/56050-1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002859	STD -96	10:4288
DOE/CS/84090-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85002836	STD -61a	10:4451
DOE/DP-48013-1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	DE85000023	MN -16	10:4402
DOE/DP/40124-47	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002820	MN -21	10:6083
48	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002821	MN -21	10:6084
49	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002816	MN -21	10:6085
51	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002813	MN -21	10:6086
54	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002814	MN -21	10:6087
60	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002819	MN -21	10:6088
62	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002812	MN -21	10:6089
68	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002625	MN -21	10:6090
71	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002817	MN -21	10:6027
DOE/DP/40159-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002989	MN -21	10:6028
DOE/DR/00789-T6	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85001463	MN -62a	10:4481
T7	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002514	MN -62	10:4482
T8	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002512	MN -62	10:4483
T10	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002513	MN -62	10:4484
DOE/EFB-84/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84016468	STD -61	10:4452
DOE/EI/02295-T3	NTIS, PC A04/MF A01 (GPO Dep.)	DE85002884	MN -13	10:4782
T4	NTIS, PC A06/MF A01 (GPO Dep.)	DE85003085	MN -13	10:4783
DOE/EIA-0145(83)	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE85003509	MN -98C	10:4307
0147(81/ 10)	NTIS, PC A02/MF A01; 1 - GPO (GPO Dep.)	DE85002269	MN -98E	10:4784
0167(83)	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	DE85002874	MN -98C	10:4308
0226(81/ 12)	NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.)	DE85002296	MN -98E	10:4780
0397(84/ 2Q)	NTIS, PC A14/MF A01; 1 - GPO (GPO Dep.)	DE85002366	MN -98E	10:4801
0436(84)	NTIS, PC A05/MF A01; 1 - GPO (GPO Dep.)	DE85002875	MN -98G	10:4355
DOE/EIS-0048-FS-1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85003133	MN -11	10:5421
DOE/ER-0045/ 12	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE84016683	STD -20c	10:6091
0046/ 17	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE84016957	MN -20c	10:6092
0046/ 18	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85002680	STD -20c	10:6093
0150/ 2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003093	STD -13	10:4808
DOE/ER/01198-T6	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85002843	MN -25	10:4879
DOE/ER/02025-5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003221	MN -34C	10:5885
DOE/ER/02026-43	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002985	MN -4	10:5007

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DOE/ER/02190-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002899	MN -4	10:5059
DOE/ER/02542-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003053	MN -4	10:5008
DOE/ER/03077-228	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85003136	MN -32	10:6001
DOE/ER/03948-16	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85003422	MN -34D	10:5813
DOE/ER/03992-562	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001835	MN -34D	10:5703
563	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001826	MN -34D	10:5704
564	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001836	MN -34D	10:5753
565	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001833	MN -34D	10:5754
566	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001834	MN -34D	10:5755
DOE/ER/05490-59	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000008	MN -34C	10:5679
DOE/ER/10332-13	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002854	MN -34C	10:5785
DOE/ER/10465-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002991	MN -4	10:4984
DOE/ER/10494-5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85003243	MN -34C	10:5857
DOE/ER/10623-T2	NTIS, PC A02; 3	DE85001576	MN -61	10:4809
DOE/ER/10645-12	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002533	MN -95f	10:4848
DOE/ER/10750-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003129	MN -28	10:5974
DOE/ER/10794-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000181	MN -61	10:4453
DOE/ER/10895-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003520	MN -48	10:5467
T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003524	MN -48	10:5468
DOE/ER/10933-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000622	MN -11	10:5589
DOE/ER/10947-3	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003026	MN -34	10:5984
DOE/ER/12003-6	NTIS, PC A03; 3	DE85003222	MN -48	10:5429
DOE/ER/13055-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002833	MN -34A	10:5648
DOE/ER/13140-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003242	MN -48	10:5430
DOE/ER/13147-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003028	MN -34	10:5009
DOE/ER/13181-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002973	MN -4	10:4985
DOE/ER/13188-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003513	MN -48	10:5442
DOE/ER/40008-66	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003236	MN -34D	10:5746
67	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003235	MN -34B	10:5626
DOE/ER/40033-65	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001832	MN -34D	10:5680
66	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001827	MN -34D	10:5681
DOE/ER/40081-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002982	MN -34C	10:5852
DOE/ER/40091-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002637	MN -20	10:6029
DOE/ER/40101-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003238	MN -34D	10:5786
DOE/ER/40105-511	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000844	MN -34D	10:5682
DOE/ER/40108-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000017	MN -34D	10:5747
DOE/ER/40136-T2	NTIS, PC A03/MF A01 (GPO Dep.)	DE85000575	MN -34A	10:5132
DOE/ER/40137-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003029	MN -34C	10:5886
DOE/ER/40143-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003241	MN -34D	10:5915
DOE/ER/53140-16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002988	MN -20g	10:6030
DOE/ER/60056-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE84015482	MN -48	10:5449
DOE/ER/60106-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002951	MN -11	10:5303
DOE/ER/60142-2	NTIS, PC A18/MF A01 (GPO Dep.)	DE84014885	STD -48	10:5480
DOE/ER/60147-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002225	MN -48	10:5541
DOE/ER/60176-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003027	MN -48	10:5060

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DOE/ET/10069-T96	NTIS (US Sales Only), PC A08/MF A01; 1 (GPO Dep.)	DE85003199	STD -90d	10:4150
DOE/ET/12307-1669	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85001963	STD -90e	10:5114
DOE/ET/14389-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003527	MN -11	10:5590
DOE/ET/20074-T31	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002697	MN -61a	10:4454
DOE/ET/20642-T2	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85000055	STD -59a	10:4517
DOE/ET/33626-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002992	MN -11	10:5469
DOE/ET/52025-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003072	MN -20	10:6031
DOE/ET/53042-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002667	MN -20	10:6032
DOE/ET/53088-156	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003162	MN -34C	10:6033
DOE/EV/04329-T2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002883	MN -11	10:5542
T3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002881	MN -11	10:5543
DOE/EV/05854-7	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003073	MN -48	10:5431
DOE/EV/10373-T1	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003174	MN -34A	10:5649
DOE/EV/10631-T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000387	MN -11	10:5304
DOE/EV/10720-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002627	MN -11	10:4787
DOE/FE/60181-84	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002495	MN -90i	10:4199
DOE/FE/60339-T5	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001890	STD -90a	10:4188
T9	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002890	STD -90a	10:4189
DOE/ID/12429-T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85003193	MN -95f	10:4849
DOE/JPL/956797-02	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002508	STD -63b	10:4455
DOE/JPL/956828-2	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000625	STD -63b	10:4456
DOE/LLW-13Te	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85002395	STD -70B	10:4393
18T-Rev.5	NTIS, PC A23/MF A01 (GPO Dep.)	DE85000643	STD -70B	10:4360
DOE/MA-0062/ 2	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85003087	MN -13	10:6232
DOE/MC/19301-5	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002509	MN -90c	10:4151
6	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003528	MN -90c	10:4152
DOE/MC/19334-1692	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85003301	STD -92a	10:4233
1693	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE85003302	STD -92a	10:4272
DOE/METC-84-10	NTIS, PC A16/MF A01; 1 (GPO Dep.)	DE84003079	STD -90	10:4153
85-1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE84011997	STD -90i	10:4200
DOE/METC/SP-212	NTIS, PC A04/MF A01 (GPO Dep.)	DE84009286	STD -90c	10:4172
DOE/NASA/0017-3	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000443	STD -97d	10:4609
DOE/NASA/20320-60	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003043	STD -60	10:4592
DOE/NBM-5003329	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003329	MN -11	10:5402
DOE/NE/44301-1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85002426	MN -70	10:4361
DOE/NV/10029-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003124	MN -96	10:4872
DOE/NV/10030-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002371	MN -96	10:4873
DOE/NV/10110-1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002370	MN -96	10:4874
DOE/OR/03054-109	NTIS, PC A09/MF A01; 1 (GPO Dep.)	DE85001633	STD -89	10:4173
DOE/OR/20722-6	NTIS, PC A18/MF A01; 1 (GPO Dep.)	DE85003149	STD -70A	10:5567
DOE/OR/21389-4	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85000798	MN -61	10:4427
DOE/OR/21400-T55	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002491	MN -48	10:5544
T60	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002485	MN -70	10:4362
DOE/ORO-5003089	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE85003089	MN -11	10:4363
DOE/PC/40783-T16	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003230	STD -90a	10:4201

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DOE/PC/40789-T11	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85001084	STD -90i	10:4190
DOE/PC/50046-15	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003103	STD -90d	10:4174
DOE/PC/50796-T7	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002860	MN -90a	10:5042
DOE/PC/60798-4	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001847	STD -90a	10:4175
DOE/PC/70795-T1	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002853	MN -90a	10:4191
DOE/PE/70097-T2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002166	MN -95d	10:4828
DOE/RA/32012-T18	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE84006902	STD -91	10:4324
DOE/RA/50219-T3	NTIS, PC A02; 3	DE84000577	MN -48	10:5550
DOE/S-0032	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002712	MN -70	10:4364
DOE/SF/00515-T40	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002852	MN -28	10:5145
DOE/SF/11537-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85003232	STD -66d	10:4587
DOE/SF/11720-T1	NTIS, PC A06/MF A01; 1	DE85002493	MN -66a	10:4582
DOE/SF/11943-T1	NTIS, PC A05/MF A01 (GPO Dep.)	DE85002758	STD -62a	10:4457
DOE/SR/00870-1-App.	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002210	MN -61	10:5470
DOT-I-84-14	GPO*	TI85900387	MN -96	10:4846
DP-MS-84-47	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002829	MN -70B	10:4365
84-53	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002826	MN -80	10:4675
84-55	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002828	MN -80	10:4404
84-113	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002822	MN -11	10:5357
DS-I-1983:21	*See* EFN-4	DE85750214	MN -98E	10:4802
DTNSRDC-84/ 027	*See* AD-A-142280/7			10:4880
DTP-83-24	*See* RL-83-126	DE85700068	MN -34D	10:5733
E-84-10159	*See* N-84-27251			10:4463
2070	*See* N-84-25017			10:4867
ECN-83-045	Netherlands Energy Research Foundation, Petten			10:4264
83-085	Netherlands Energy Research Foundation, Petten			10:4202
149	NTIS (US Sales Only), PC A08/MF A01	DE85780202	MN -25	10:4968
EFN-4	NTIS (US Sales Only), PC A11/MF A01; 1	DE85750214	MN -98E	10:4802
EGG-2343	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE85002806	STD -93	10:4829
ENEA-RT/FI-83-4	NTIS (US Sales Only), PC A02/MF A01	DE85700175	MN -46	10:5950
ENEA-RT/FIMA-83-7	NTIS (US Sales Only), PC A03/MF A01	DE85700158	MN -93	10:6094
ENEA-RT/ING-82-26	NTIS (US Sales Only), PC A02/MF A01	DE85780208	MN -71	10:5076
82-27	NTIS (US Sales Only), PC A02/MF A01	DE85780211	MN -80	10:4650
82-29	NTIS (US Sales Only), PC A02/MF A01	DE85780215	MN -79	10:4720
83-4	NTIS (US Sales Only), PC A02/MF A01	DE85780216	MN -79	10:4651
EPA/600-D-84-173	*See* PB-84-222215			10:5117
EPA/600/3-84-086	*See* PB-84-232545			10:5403
EPRI-CS-3723	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $35.50	TI85920134	ND -90i	10:4211
ERP/ERL-80-25(OP)	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			10:4265
ERP/MRL-79-9(OP)	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			10:4234
79-81(OPJ)	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			10:4235
ERP/MSL-79-80(OP)	Canada Centre for Mineral and Energy Technology, Ottawa, Ontario			10:4263
ESA-TT-859	*See* N-84-25039			10:5086
EUR-7633-DE-EN-FR-IT	Commission of the European Communities, Luxembourg			10:4147

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8358	NTIS PC 05/MF E05			10:4865
8358-EN	*See* EUR-8358			10:4865
8523-EN	Commission of the European Communities, Luxembourg		ND -59	10:4518
8633	NTIS (US Sales Only), PC A05/MF A01	DE85780198	MN -25	10:4721
8648-EN	*See* PB-84-236249			10:5515
8731	NTIS PC E06/MF E06			10:4583
8731-EN	*See* EUR-8731			10:4583
8753	NTIS (US Sales Only), PC A04/MF A01	DE85780194	MN -4	10:4986
8812	NTIS (US Sales Only), PC A11/MF A01	DE85780219	MN -70	10:4366
8922	NTIS (US Sales Only), PC A10/MF A01	DE85780220	MN -70	10:4367
9074-EN/ IT	Concepcion Univ. (Chile). Departamento de Fisiopatologia			10:4866
9126-d,e,f	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			10:4236
9151-EN,DA,DE,FR,IT,NL	European Community Information Service, 2100 M St., NW, Suite 707, Washington, DC 20037			10:4269
FE-				
2893-135	*See* DOE/ET/10069-T96	DE85003199	STD -90d	10:4150
FEI-				
1421	NTIS (US Sales Only), PC A02/MF A01	DE84703368	MN -34C	10:5879
1486	NTIS (US Sales Only), PC A02/MF A01	DE84703305	MN -32	10:5951
1487	NTIS (US Sales Only), PC A02/MF A01	DE84703264	MN -38	10:5092
1488	NTIS (US Sales Only), PC A02/MF A01	DE84703281	MN -80	10:4623
1494	NTIS (US Sales Only), PC A02/MF A01	DE84703265	MN -38	10:5093
1496	NTIS (US Sales Only), PC A02/MF A01	DE84703292	MN -79	10:4652
1498	NTIS (US Sales Only), PC A02/MF A01	DE84703266	MN -28	10:5146
FFA-TN-				
1983-31	*See* N-84-28262			10:4595
FFWG-P-				
83-14	*See* AERE-R-11159		ND -80	10:4681
FLPU-				
83-4	NTIS (US Sales Only), PC A03/MF A01	DE85780203	MN -51	10:4368
83-9	NTIS (US Sales Only), PC A06/MF A01	DE85780096	MN -51	10:5603
FNAL/C-				
84/ 90-A	NTIS, PC A02; 3	DE85002190	MN -34B	10:5627
FNAL-TM-				
1254	NTIS, PC A03; 3	DE84016716	MN -28	10:5133
FOA-B-				
60004-M7	*See* PB-84-231208			10:4278
FOA-C-				
20544-T1	*See* PB-84-234848			10:4743
30365-A3	*See* PB-84-209063			10:5274
FRP-				
81/ 11	NTIS (US Sales Only), PC A06/MF A01	DE85780199	MN -25	10:5104
81/ 12	NTIS (US Sales Only), PC A04/MF A01	DE85780200	MN -25	10:4629
FS-				
83-30-T	NTIS (US Sales Only), PC A99/MF A01	DE85750007	MN -41	10:5207
GA-A-				
17664	NTIS, PC A07/MF A01 (GPO Dep.)	DE85003156	STD -20	10:6095
17742	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85003059	STD -20	10:6096
GKSS-				
83/ E/ 80	NTIS (US Sales Only), PC A03/MF A01	DE84752282	MN -11	10:5399
84/ E/ 16	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750261	MN -60	10:4593
84/ E/ 24	NTIS (US Sales Only), PC A02/MF A01; 1	DE85750263	MN -38	10:5094
84/ E/ 26	NTIS (US Sales Only), PC A02/MF A01	DE85750264	MN -25	10:4899
GRS-A-				
924	*See* BMI-1984-044	DE85750014	MN -80	10:4683
GSF-				
A4/ 83	*See* FS-83-30-T	DE85750007	MN -41	10:5207
GSI-				
84-35-Prepr.	NTIS (US Sales Only), PC A032/MF A01	DE85750015	MN -34C	10:5880
HEDL-				
7481	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002636	MN -38	10:4790
7487	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003005	MN -20c	10:4900
7490	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003004	MN -20c	10:4901
7491	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003006	MN -20c	10:4902
7494	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002995	MN -25	10:4903
7501	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003001	MN -20c	10:4904
7502	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003002	MN -25	10:4905
7503	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003007	MN -20c	10:4906
HEDL-SA-				
2853-FP	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85003000	MN -25	10:4338
2947-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003011	MN -25	10:5077
3037-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003019	MN -25	10:4907
3038	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003012	MN -25	10:4699
3098-FP	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001060	MN -78	10:4630
3108-FP	NTIS, PC A02; 3	DE85001065	MN -79m	10:4700
3152-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003014	MN -20c	10:4908
3156-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003010	MN -79b	10:4653
3159-FP	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003013	MN -79e	10:4701
3177-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003015	MN -20e	10:6097
3193-FP	NTIS, PC A02; 3	DE85001427	MN -41	10:5559

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3198-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001063	MN -41	10:5560
3218-FP	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002998	MN -79k	10:4654
3226	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002997	MN -79h	10:4655
HEDL-TC-				
2353-3	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002693	MN -85	10:4369
HHE-				
75-046	*See* PB-84-241793			10:5319
HSE-Trans-				
7270	NTIS (US Sales Only), PC A02; 3	TI84901841	MN -41	10:4271
7274	NTIS (US Sales Only), PC A02; 3	DE84901842	MN -41	10:4262
7294	NTIS (US Sales Only), PC A02; 3	DE85900056	MN -90i	10:4270
IA-				
1382	NTIS (US Sales Only), PC A03/MF A01	DE84703393	MN -4	10:4969
IAE-				
3640/ 15	NTIS (US Sales Only), PC A02/MF A01	DE84703299	MN -37	10:5147
IAEA-R-				
2415-F	NTIS (US Sales Only), PC A06/MF A01	DE84703258	MN -41	10:5395
2462-F	NTIS (US Sales Only), PC A02/MF A01	DE84703259	MN -41	10:5243
2463-F	NTIS (US Sales Only), PC A03/MF A01	DE84703251	MN -11	10:5411
2726-F	NTIS (US Sales Only), PC A02/MF A01	DE84703256	MN -48	10:5471
2740-F	NTIS (US Sales Only), PC A03/MF A01	DE84703260	MN -41	10:5509
3376-F	NTIS (US Sales Only), PC A02/MF A01	DE84703263	MN -48	10:5454
IAEA-RL-				
79	NTIS (US Sales Only), PC A02/MF A01	DE84703304	MN -16	10:4403
82	NTIS (US Sales Only), PC A03/MF A01	DE84703390	MN -34C	10:5846
110	NTIS (US Sales Only), PC A03/MF A01	DE84703245	MN -4	10:4987
111	NTIS (US Sales Only), PC A03/MF A01	DE84703250	MN -51	10:5396
112	NTIS (US Sales Only), PC A07/MF A01	DE84703239	MN -4	10:4988
IC-				
83/ 121	NTIS (US Sales Only), PC A02/MF A01	DE85700007	MN -34D	10:6002
83/ 142	NTIS (US Sales Only), PC A02/MF A01	DE85700001	MN -34D	10:6003
83/ 147	NTIS (US Sales Only), PC A02/MF A01	DE85700008	MN -34D	10:6004
83/ 149	NTIS (US Sales Only), PC A02/MF A01	DE85700009	MN -34D	10:5985
83/ 165	NTIS (US Sales Only), PC A02/MF A01	DE85700010	MN -34D	10:6005
83/ 166	NTIS (US Sales Only), PC A02/MF A01	DE85700025	MN -34D	10:5705
83/ 174	NTIS (US Sales Only), PC A02/MF A01	DE85700002	MN -34D	10:6006
83/ 177	NTIS (US Sales Only), PC A02/MF A01	DE85700079	MN -34C	10:5782
83/ 178	NTIS (US Sales Only), PC A02/MF A01	DE85700011	MN -34D	10:5986
83/ 180	NTIS (US Sales Only), PC A03/MF A01	DE85700026	MN -34D	10:5756
83/ 181	NTIS (US Sales Only), PC A02/MF A01	DE85700075	MN -34C	10:5706
83/ 183	NTIS (US Sales Only), PC A03/MF A01	DE85700027	MN -34D	10:5757
83/ 184	NTIS (US Sales Only), PC A02/MF A01	DE85700055	MN -34B	10:5628
83/ 186	NTIS (US Sales Only), PC A02/MF A01	DE85700003	MN -34D	10:6007
83/ 187	NTIS (US Sales Only), PC A02/MF A01	DE85700043	MN -34A	10:5975
83/ 189	NTIS (US Sales Only), PC A02/MF A01	DE85700017	MN -34D	10:6008
83/ 193	NTIS (US Sales Only), PC A02/MF A01	DE85700053	MN -34B	10:4441
83/ 194	NTIS (US Sales Only), PC A02/MF A01	DE85780099	MN -34B	10:5306
83/ 195	NTIS (US Sales Only), PC A02/MF A01	DE85700004	MN -34D	10:6009
83/ 196	NTIS (US Sales Only), PC A02/MF A01	DE85700052	MN -20	10:6034
83/ 197	NTIS (US Sales Only), PC A02/MF A01	DE85700076	MN -34C	10:5916
83/ 198	NTIS (US Sales Only), PC A02/MF A01	DE85700077	MN -34C	10:5917
83/ 199	NTIS (US Sales Only), PC A02/MF A01	DE85700005	MN -34D	10:6010
83/ 202	NTIS (US Sales Only), PC A02/MF A01	DE85700006	MN -34D	10:6011
83/ 203	NTIS (US Sales Only), PC A02/MF A01	DE85700080	MN -34C	10:5835
83/ 205	NTIS (US Sales Only), PC A02/MF A01	DE85700057	MN -34B	10:5629
83/ 208	NTIS (US Sales Only), PC A02/MF A01	DE85700060	MN -34B	10:5987
83/ 210	NTIS (US Sales Only), PC A03/MF A01	DE85700018	MN -34D	10:5758
83/ 211	NTIS (US Sales Only), PC A02/MF A01	DE85700044	MN -34A	10:5976
83/ 212	NTIS (US Sales Only), PC A02/MF A01	DE85700045	MN -34A	10:5977
83/ 213	NTIS (US Sales Only), PC A03/MF A01	DE85700054	MN -34B	10:4442
83/ 214	NTIS (US Sales Only), PC A03/MF A01	DE85700028	MN -34D	10:5759
83/ 222	NTIS (US Sales Only), PC A02/MF A01	DE85780100	MN -34B	10:5683
83/ 223	NTIS (US Sales Only), PC A02/MF A01	DE85700081	MN -34C	10:5795
83/ 228	NTIS (US Sales Only), PC A02/MF A01	DE85700082	MN -34C	10:5707
ICTIS/TR-				
26	*See* PB-84-233238			10:4180
IFIN-FT-				
201-1981	NTIS (US Sales Only), PC A03/MF A01	DE85700166	MN -34D	10:5708
204-1981	NTIS (US Sales Only), PC A02/MF A01	DE85700161	MN -34D	10:5918
209-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700167	MN -34D	10:5760
210-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700168	MN -34D	10:5761
212-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700159	MN -34D	10:5709
216-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700180	MN -34C	10:5866
218-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700162	MN -34D	10:5710
219-1982	NTIS (US Sales Only), PC A03/MF A01	DE85700169	MN -34D	10:5783
220-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700181	MN -34C	10:5919
222-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700151	MN -34D	10:5988
236-1984	NTIS (US Sales Only), PC A03/MF A01	DE85700177	MN -34C	10:5920
IFIN-HE-				
101-1981	NTIS (US Sales Only), PC A03/MF A01	DE85700171	MN -34D	10:5796
102-1981	NTIS (US Sales Only), PC A02/MF A01	DE85700172	MN -34D	10:5684
104-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700163	MN -34D	10:5711
IFIN-NP-				
22-1981	NTIS (US Sales Only), PC A02/MF A01	DE85700176	MN -34C	10:5952

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IFIN-RB-				
4-1981	NTIS (US Sales Only), PC A03/MF A01	DE85780217	MN -37	10:5276
6-1981	NTIS (US Sales Only), PC A03/MF A01	DE85780206	MN -48	10:5455
IFSR-				
156	*See* DOE/ET/53088-156	DE85003162	MN -34C	10:6033
IFTAR-FT-				
208-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700179	MN -34C	10:6035
IFTAR-LOP-				
22-1981	NTIS (US Sales Only), PC A02/MF A01	DE85700154	MN -20	10:6036
27-1982	NTIS (US Sales Only), PC A02/MF A01	DE85700156	MN -20	10:6037
43-1984	NTIS (US Sales Only), PC A03/MF A01	DE85700152	MN -34D	10:5989
IFVE-OEIPK-				
83-43	NTIS (US Sales Only), PC A02/MF A01	DE84703362	MN -34D	10:5685
83-93	NTIS (US Sales Only), PC A02/MF A01	DE84703347	MN -34D	10:5712
83-97	NTIS (US Sales Only), PC A02/MF A01	DE84703363	MN -34D	10:5686
83-128	NTIS (US Sales Only), PC A02/MF A01	DE84703360	MN -34D	10:5687
83-152	NTIS (US Sales Only), PC A02/MF A01	DE84703361	MN -34D	10:5688
IFVE-OTF-				
83-49	NTIS (US Sales Only), PC A02/MF A01	DE84703348	MN -34D	10:5713
INFN/AE-				
82-2	NTIS (US Sales Only), PC A04/MF A01	DE85700173	MN -34D	10:5788
INFN/BE-				
83-9	NTIS (US Sales Only), PC A02/MF A01	DE85700182	MN -34C	10:5814
INFN-LNF-				
82-27(CR)	NTIS (US Sales Only), PC A02/MF A01	DE85700174	MN -34D	10:5797
INIS-mf-				
9066	NTIS (US Sales Only), PC A04/MF A01	DE84703300	MN -70	10:4370
INP-				
1181/ AP	NTIS (US Sales Only), PC A03/MF A01	DE84703367	MN -46	10:5953
1199/ PL	NTIS (US Sales Only), PC A04/MF A01	DE84703377	MN -34C	10:5867
1200/ PL	NTIS (US Sales Only), PC A03/MF A01	DE84703389	MN -34C	10:5847
INS-				
460	NTIS (US Sales Only), PC A03/MF A01	DE84703236	MN -34C	10:5921
464	NTIS (US Sales Only), PC A03/MF A01	DE84703235	MN -34C	10:5922
INS-NUMA-				
45	NTIS (US Sales Only), PC A04/MF A01	DE84703269	MN -28	10:5134
50	NTIS (US Sales Only), PC A03/MF A01	DE84703271	MN -28	10:5148
INS-TH-				
150	NTIS (US Sales Only), PC A02/MF A01	DE84703297	MN -37	10:5244
152	NTIS (US Sales Only), PC A02/MF A01	DE84703274	MN -28	10:5149
INS-TL-				
144	NTIS (US Sales Only), PC A06/MF A01	DE84703296	MN -37	10:5245
INTRON-				
82272	INTRON B.V., Maastricht, Netherlands			10:4203
83006	INTRON B.V., Maastricht, Netherlands			10:4204
IOS-Rep-				
178	NTIS (US Sales Only), PC A04/MF A01	DE85780097	MN -11	10:5412
IPEN-Pub-				
58	NTIS (US Sales Only), PC A02/MF A01	DE85780196	MN -4	10:5061
59	NTIS (US Sales Only), PC A02/MF A01	DE85780195	MN -4	10:4989
IS-M-				
519	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002678	MN -25	10:4952
520	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002677	MN -25	10:4909
521	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002681	MN -25	10:4910
523	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003066	MN -34	10:5978
526	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003068	MN -34	10:5105
527	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003080	MN -25	10:4911
ITEF-				
137(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84703267	MN -28	10:5135
146(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84703306	MN -32	10:5277
183(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84703382	MN -34C	10:5887
184(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84703383	MN -34C	10:5858
ITEP-				
56(1983)	NTIS (US Sales Only), PC A02/MF A01	DE84703369	MN -34C	10:5932
ITPR-				
81013	NTIS (US Sales Only), PC A07/MF A01	DE84703346	MN -34A	10:4912
IVA-				
252	NTIS (US Sales Only), PC A08/MF A01; 1	DE85750212	MN -95	10:4794
259	NTIS (US Sales Only), PC A08/MF A01; 1	DE85750228	MN -13	10:4803
261	NTIS (US Sales Only), PC A08/MF A01; 1	DE85750227	MN -94	10:4804
IVL-B-				
750	NTIS (US Sales Only), PC A06/MF A01; 1	DE85750222	MN -41	10:5307
JAERI-				
M-83-084	NTIS (US Sales Only), PC A03/MF A01	DE84703253	MN -34B	10:5345
JAERI-M-				
83-027	NTIS (US Sales Only), PC A04/MF A01	DE84703283	MN -78	10:4724
83-060	NTIS (US Sales Only), PC A03/MF A01	DE84703246	MN -4	10:5058
83-061	NTIS (US Sales Only), PC A03/MF A01	DE84703238	MN -34C	10:6098
83-067	NTIS (US Sales Only), PC A03/MF A01	DE84703284	MN -78	10:4725
83-071	NTIS (US Sales Only), PC A07/MF A01	DE84703252	MN -34B	10:5346
83-075	NTIS (US Sales Only), PC A17/MF A01	DE84703279	MN -80	10:4658
83-081	NTIS (US Sales Only), PC A06/MF A01	DE84703285	MN -78	10:4633
83-088	NTIS (US Sales Only), PC A04/MF A01	DE84703286	MN -78	10:4726
83-089	NTIS (US Sales Only), PC A02/MF A01	DE84703278	MN -25	10:5106

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83-090	NTIS (US Sales Only), PC A05/MF A01	DE84703287	MN -78	10:4727
83-091	NTIS (US Sales Only), PC A06/MF A01	DE84703288	MN -78	10:4728
83-092	NTIS (US Sales Only), PC A05/MF A01	DE84703290	MN -77	10:4640
83-093	NTIS (US Sales Only), PC A02/MF A01	DE84703291	MN -77	10:4641
83-097	NTIS (US Sales Only), PC A03/MF A01	DE84703289	MN -78	10:4634
83-098	NTIS (US Sales Only), PC A02/MF A01	DE84703257	MN -41	10:5347
83-113	NTIS (US Sales Only), PC A03/MF A01	DE84703307	MN -32	10:5348
83-123	NTIS (US Sales Only), PC A05/MF A01	DE84703303	MN -2	10:4329
83-144	NTIS (US Sales Only), PC A03/MF A01	DE84703308	MN -32	10:5954
JINR-				
1-83-652	NTIS (US Sales Only), PC A02/MF A01	DE84703366	MN -34D	10:5692
D-1-83-602	NTIS (US Sales Only), PC A02/MF A01	DE84703384	MN -34C	10:5718
E-1-83-670	NTIS (US Sales Only), PC A02/MF A01	DE84703385	MN -34C	10:5822
E-2-83-630	NTIS (US Sales Only), PC A02/MF A01	DE85700063	MN -34D	10:5719
E-2-83-775	NTIS (US Sales Only), PC A02/MF A01	DE84703370	MN -34C	10:5936
E-4-82-300	NTIS (US Sales Only), PC A02/MF A01	DE84703371	MN -34C	10:5868
E-4-83-680	NTIS (US Sales Only), PC A02/MF A01	DE84703372	MN -34C	10:5836
R-1-83-565	NTIS (US Sales Only), PC A02/MF A01	DE84703237	MN -34C	10:5806
R-1-83-571	NTIS (US Sales Only), PC A02/MF A01	DE84703386	MN -34C	10:5823
R-1-83-805	NTIS (US Sales Only), PC A02/MF A01	DE84703364	MN -34D	10:5693
R-1-83-823	NTIS (US Sales Only), PC A02/MF A01	DE84703365	MN -34D	10:5694
R-2-83-746	NTIS (US Sales Only), PC A02/MF A01	DE84703352	MN -34D	10:5720
R-2-83-749	NTIS (US Sales Only), PC A02/MF A01	DE84703373	MN -34C	10:5807
R-3-83-820	NTIS (US Sales Only), PC A02/MF A01	DE85700090	MN -34C	10:5650
R-4-83-463	NTIS (US Sales Only), PC A02/MF A01	DE84703374	MN -34C	10:5860
R-4-83-741	NTIS (US Sales Only), PC A02/MF A01	DE84703375	MN -34C	10:5881
R-7-83-809	NTIS (US Sales Only), PC A02/MF A01	DE84703387	MN -34C	10:5869
JINR-R-				
6-83-585	NTIS (US Sales Only), PC A02/MF A01	DE85700091	MN -34C	10:5861
JPL-				
84-13	*See* N-84-28224			10:4486
9950-886	*See* N-84-28215			10:4467
9950-901	*See* N-84-28209			10:4465
9950-905	*See* N-84-28221			10:4470
9950-908	*See* N-84-28208			10:4464
9950-922	*See* N-84-28216			10:4468
JPL-PUB-				
83-90	*See* N-84-25167			10:4850
84-25	*See* N-84-28217			10:4558
84-30	*See* N-84-28218			10:4485
JPL-PUBL-				
83-88	*See* N-84-28267			10:4471
83-97	*See* N-84-28223			10:4559
84-8	*See* N-84-28220			10:4469
84-9	*See* N-84-28212			10:4557
84-24	*See* N-84-28210			10:4466
Juel-Spez-				
252	NTIS (US Sales Only), PC A03/MF A01; 1	DE84752279	MN -38	10:5110
K/D-				
5590	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002072	MN -38	10:4781
K/TS-				
5360	NTIS, PC A02; 3	DE84016809	MN -22	10:4330
KAERI/RR-				
321/ 81	NTIS (US Sales Only), PC A05/MF A01	DE85780091	MN -25	10:4913
KEK-				
82-9	NTIS (US Sales Only), PC A03/MF A01	DE84703298	MN -37	10:5256
82-10	NTIS (US Sales Only), PC A02/MF A01	DE84703275	MN -28	10:5203
82-11	NTIS (US Sales Only), PC A03/MF A01	DE84703309	MN -32	10:5127
82-12	NTIS (US Sales Only), PC A02/MF A01	DE84703276	MN -28	10:5204
82-13	NTIS (US Sales Only), PC A02/MF A01	DE84703272	MN -28	10:5136
82-15	NTIS (US Sales Only), PC A04/MF A01	DE84703277	MN -28	10:5137
KFK-				
3687	NTIS (US Sales Only), PC A02/MF A01	DE84752263	ND -80	10:4729
3729	NTIS (US Sales Only), PC A03/MF A01	DE85750012	MN -25	10:4915
3751	NTIS (US Sales Only), PC A03/MF A01	DE85750019	MN -11	10:5349
KFKI-				
1984-10	NTIS (US Sales Only), PC A02/MF A01	DE85700061	MN -34B	10:5630
1984-17	NTIS (US Sales Only), PC A02/MF A01	DE85700051	MN -20	10:6038
1984-28	NTIS (US Sales Only), PC A02/MF A01	DE85700083	MN -34C	10:5938
1984-33	NTIS (US Sales Only), PC A02/MF A01	DE85700070	MN -34D	10:5990
1984-34	NTIS (US Sales Only), PC A02/MF A01	DE85700019	MN -34D	10:5631
1984-35	NTIS (US Sales Only), PC A02/MF A01	DE85700078	MN -34C	10:5939
1984-41	NTIS (US Sales Only), PC A03/MF A01	DE85700056	MN -34B	10:5632
1984-43	NTIS (US Sales Only), PC A02/MF A01	DE85700020	MN -34D	10:5991
1984-45	NTIS (US Sales Only), PC A02/MF A01	DE85700029	MN -34D	10:5762
1984-47	NTIS (US Sales Only), PC A02/MF A01	DE85700030	MN -34D	10:5763
1984-51	NTIS (US Sales Only), PC A02/MF A01	DE85700065	MN -34D	10:5721
1984-52	NTIS (US Sales Only), PC A02/MF A01	DE85700066	MN -34D	10:5722
1984-53	NTIS (US Sales Only), PC A02/MF A01	DE85700084	MN -34C	10:5940
1984-55	NTIS (US Sales Only), PC A02/MF A01	DE85780081	MN -4	10:4990
1984-62	NTIS (US Sales Only), PC A02/MF A01	DE85700021	MN -34D	10:5992
1984-63	NTIS (US Sales Only), PC A02/MF A01	DE85700022	MN -34D	10:5764
1984-64	NTIS (US Sales Only), PC A02/MF A01	DE85700023	MN -34D	10:5993

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KHM-TR-				
68	NTIS (US Sales Only), PC A06/MF A01; 1	DE85750213	MN -90i	10:4205
KISU-				
66	*See* SUNI-66	DE84703318	MN -2	10:5121
KIYI-				
83-3	NTIS (US Sales Only), PC A02/MF A01	DE84703391	MN -4	10:4991
83-23	NTIS (US Sales Only), PC A02/MF A01	DE84703388	MN -34C	10:5808
KMU-HEP-				
83-04(Rev.)	NTIS (US Sales Only), PC A02/MF A01	DE85700170	MN -34D	10:5765
83-06	NTIS (US Sales Only), PC A03/MF A01	DE85700164	MN -34D	10:5723
83-08	NTIS (US Sales Only), PC A02/MF A01	DE85700160	MN -34D	10:5724
83-09	NTIS (US Sales Only), PC A02/MF A01	DE85700165	MN -34D	10:5725
KURRI-TR-				
232	NTIS (US Sales Only), PC A06/MF A01	DE84703261	MN -41	10:4693
234	NTIS (US Sales Only), PC A07/MF A01	DE84703282	MN -80	10:4730
L-				
15801	*See* N-84-28131			10:5641
LA-				
9958-PR	NTIS, PC A06/MF A01 (GPO Dep.)	DE85002304	STD -41	10:5561
10203-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002305	STD -45	10:5282
LA-tr-				
84-33	NTIS, PC A02; 3	DE84017212	MN -79b	10:4665
LA-UR-				
84-2569	NTIS, PC A02; 3	DE84016748	MN -11	10:5358
84-2733	NTIS, PC A02; 3	DE84016776	MN -34D	10:5726
84-2819	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002019	MN -34C	10:5837
84-3057	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002051	MN -32	10:5994
84-3089	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000655	MN -32	10:6012
84-3139	NTIS, PC A02; 3	DE85000659	MN -32	10:6248
84-3304	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002383	MN -37	10:5257
84-3305	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002382	MN -37	10:5258
84-3315	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002381	MN -78	10:4731
84-3316	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002380	MN -78	10:4732
84-3317	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002390	MN -78	10:4733
84-3339	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002436	MN -48	10:5432
84-3378	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002420	MN -34C	10:5809
84-3389	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002378	MN -37	10:5259
84-3396	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002417	MN -48	10:5433
LAIR-				
84-48	*See* AD-A-144210/2			10:5548
LBL-				
17634	NTIS, PC A02; 3	DE85001654	MN -28	10:5138
17635	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001399	STD -70	10:4371
17996	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002886	MN -28	10:5168
18103	NTIS, PC A02; 3	DE85001647	MN -94cc	10:4768
18247	NTIS, PC A02; 3	DE85000619	MN -59b	10:4830
18406	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001649	MN -34D	10:5766
18475	NTIS, PC A13/MF A01; 1 (GPO Dep.)	DE85003522	MN -34	10:5793
LC-				
84-601040	*See* N-84-28192			10:4275
LIS-				
27	Landesanstalt fuer Immissionsschutz des Landes Nordrhein-Westfalen, Essen (Germany, F.R.)			10:5308
LR-				
390	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	10:4594
LRAP-				
32	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750231	MN -11	10:5389
MHSMP-				
84-37	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002652	STD -41	10:5283
MLR-				
1807	NTIS, PC A05/MF A01 (GPO Dep.)	DE85000719	MN -37	10:5112
MPD/NBS-				
244	*See* AERE-R-11127	TI85900269	ND -34A	10:4962
MPI-PAE/Exp.El.-				
129	NTIS (US Sales Only), PC A02/MF A01	DE85750017	MN -37	10:5260
130	NTIS (US Sales Only), PC A02/MF A01	DE85750009	MN -37	10:5261
131	NTIS (US Sales Only), PC A02/MF A01	DE85750016	MN -37	10:5262
MRL-R-				
910	*See* AD-A-143183/2			10:4405
922	*See* AD-A-142789/7			10:5081
922	*See* N-84-26020			10:5087
MRP/MRL-				
81-41(TR)	NTIS (US Sales Only), PC A05/MF A01	DE85780092	MN -51	10:4397
MRP/MSL-				
80-166(IR)	NTIS (US Sales Only), PC A03/MF A01	DE85780093	MN -51	10:4327
N-				
84-24656	NTIS, PC A09/MF A01			10:4458
84-24657	NTIS, PC A09/MF A01			10:4459
84-24658	NTIS, PC A09/MF A01			10:4460
84-25017	NTIS, PC A02/MF A01			10:4867
84-25039	NTIS, PC A07/MF A01			10:5086
84-25161	International Inst. for Applied Systems Analysis, Laxenburg, Austria			10:4306
84-25162	NTIS, PC A04/MF A01			10:4479

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84-25163	NTIS, PC A05/MF A01			10:4480
84-25167	NTIS, PC A03/MF A01			10:4850
84-25168	NTIS, PC A02/MF A01			10:4461
84-25170	NTIS, PC A05/MF A01			10:4766
84-25171	NTIS, PC A03/MF A01			10:4556
84-25172	NTIS, PC A05/MF A01			10:4462
84-25596	NTIS, PC A03/MF A01			10:4586
84-26020	NTIS, PC A02/MF A01			10:5087
84-26126	NTIS, PC A13/MF A01			10:4519
84-26127	NTIS, PC A13/MF A01			10:4520
84-26128	NTIS, PC A13/MF A01			10:4521
84-26129	NTIS, PC A13/MF A01			10:4522
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84-26135	NTIS, PC A13/MF A01			10:4525
84-26136	NTIS, PC A13/MF A01			10:4526
84-26137	NTIS, PC A13/MF A01			10:4527
84-26138	NTIS, PC A13/MF A01			10:4528
84-26139	NTIS, PC A13/MF A01			10:4529
84-26140	NTIS, PC A13/MF A01			10:4530
84-26141	NTIS, PC A13/MF A01			10:4531
84-26142	NTIS, PC A13/MF A01			10:4532
84-26143	NTIS, PC A13/MF A01			10:4533
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84-26145	NTIS, PC A13/MF A01			10:4833
84-26146	NTIS, PC A13/MF A01			10:4834
84-26147	NTIS, PC A13/MF A01			10:4535
84-26148	NTIS, PC A13/MF A01			10:4536
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2320	*See* N-84-28131			10:5641
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168181	*See* N-84-25162			10:4479
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173553	*See* N-84-25167			10:4850
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174721	*See* DOE/NASA/0017-3	DE85000443	STD -97d	10:4609
NASA-TM-				
83681	*See* N-84-25017			10:4867
86867	*See* DOE/NASA/20320-60	DE85003043	STD -60	10:4592
NBI-HE-				
84-10	NTIS (US Sales Only), PC A04/MF A01	DE84703355	MN -34D	10:5767
NBS-GCR-				
84-475	NTIS, PC A04/MF A01 (GPO Dep.)	DE85002194	MN -59a	10:4574
NBSIR-				
84-2872	*See* PB-84-217090			10:4861
ND-R-				
921(S)	HMSO, London, price Pound 6.00		ND -25	10:4992
NE-BF-				
83-8	NTIS (US Sales Only), PC A20/MF A01; 1	DE85750234	MN -96	10:4877
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21(586)	NTIS (US Sales Only), PC A02/MF A01	DE84703293	MN -79	10:4703
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0585	NTIS (US Sales Only), PC A02/MF A01	DE84703268	MN -28	10:5169
NIKHEF-H-				
84-2	NTIS (US Sales Only), PC A02/MF A01	DE84703351	MN -34D	10:5727
84-3	NTIS (US Sales Only), PC A03/MF A01	DE84703350	MN -34D	10:5728
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1984	NTIS (US Sales Only), PC A03/MF A01	DE84901319	MN -37	10:5278
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21-Vol.1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002969	MN -92	10:4283
21-Vol.2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003126	MN -92	10:4286
21-Vol.3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002971	MN -92	10:4878
NIRS-				
19	NTIS (US Sales Only), PC A06/MF A01	DE84703315	MN -2	10:5511
20	NTIS (US Sales Only), PC A06/MF A01	DE84703316	MN -2	10:5512
21	NTIS (US Sales Only), PC A05/MF A01	DE84703317	MN -2	10:5513
NIRS-AR-				
24	NTIS (US Sales Only), PC A09/MF A01	DE84703314	MN -2	10:5514
NLR-MP-				
83047-U	*See* N-84-28263			10:4596
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2-71-4224	NTIS, PC A08/MF A01 - NMERDI, Univ. of New Mexico, 457 Washington SE, Albuquerque, NM 87108; 1	DE85900194	MN -95d	10:4835
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5770003	NTIS (US Sales Only), PC A02/MF A01; 1	DE85770003	MN -88	10:5078
5770006	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770006	MN -38	10:5095
5770007	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770007	MN -38	10:5096
5770008	NTIS (US Sales Only), PC A06/MF A01; 1	DE85770008	MN -38	10:5097
5770009	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770009	MN -97	10:4610
5770010	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770010	MN -38	10:5098
5770011	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770011	MN -38	10:4611
5770012	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770012	MN -97	10:4612
5770013	NTIS (US Sales Only), PC A06/MF A01; 1	DE85770013	MN -98	10:4851

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5770014	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770014	MN -90c	10:4178
5770015	NTIS (US Sales Only), PC A05/MF A01; 1	DE85770015	MN -96	10:4769
5770016	NTIS (US Sales Only), PC A11/MF A01; 1	DE85770016	MN -96	10:4870
5770017	NTIS (US Sales Only), PC A06/MF A01; 1	DE85770017	MN -63	10:4472
5770018	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770018	MN -38	10:5099
5770019	NTIS (US Sales Only), PC A10/MF A01; 1	DE85770019	MN -95	10:4795
5770020	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770020	MN -38	10:5100
5770021	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770021	MN -97	10:4613
5770022	NTIS (US Sales Only), PC A08/MF A01; 1	DE85770022	MN -97	10:4620
5770023	NTIS (US Sales Only), PC A09/MF A01; 1	DE85770023	MN -59b	10:4540
5770024	NTIS (US Sales Only), PC A05/MF A01; 1	DE85770024	MN -59a	10:4541
5770025	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770025	MN -97	10:4621
5770026	NTIS (US Sales Only), PC A07/MF A01; 1	DE85770026	MN -97	10:4614
5770106	NTIS (US Sales Only), PC A14/MF A01; 1	DE85770106	MN -11	10:5314
5900011	NTIS (US Sales Only), PC A05/MF A01; 1	DE85900011	MN -59a	10:4575
5900014	NTIS (US Sales Only), MF A01; 2	DE85900014	MN -59b	10:4542
5900015	NTIS (US Sales Only), PC A05/MF A01; 1	DE85900015	MN -59a	10:4543
5900024	NTIS (US Sales Only), PC A06/MF A01; 1	DE85900024	MN -59a	10:4576
5900105	NTIS (US Sales Only), PC A09/MF A01; 1	DE85900105	MN -59a	10:4577
5900107	NTIS (US Sales Only), PC A10/MF A01; 1	DE85900107	MN -59a	10:4544
5900128	SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486	TI85900128	MN -91	10:4321
5900193	NTIS, PC A04/MF A01	DE85900193	MN -70	10:4372
5900277	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900277	MN -98B	10:5420
5900400	SOMED, Box 6282, Univ. of Alabama, University (Tuscaloosa), AL 35486	TI85900400	MN -92a	10:4284
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760	NTIS (US Sales Only), PC A03/MF A01	DE85780221	MN -70	10:4373
NPS-				
61-84-007	*See* AD-A-143088/3			10:5947
61-84-008	*See* AD-A-143128/7			10:5130
NR-				
83/ 52	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4193
83/ 59	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4268
NRL-MR-				
4688	*See* AD-A-142822/6			10:5123
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5402	*See* AD-A-145026/1			10:5625
NUREG-				
0020-Vol.8-No.9	NTIS, PC A18/MF A01 - GPO*	TI85900222	MN -78	10:4622
0040-Vol.8-No.3	NTIS, PC A09/MF A01 - GPO*	TI85900174	MN -80	10:4668
0383-Vol.1-Rev.7	NTIS, PC A19/MF A01 - GPO* $9.00	TI85900340	MN -71	10:4352
0383-Vol.3-Rev.4	NTIS, PC A07/MF A01 - GPO* $5.00	TI85900315	MN -71	10:4353
0683-Suppl.1	NTIS, PC A08/MF A01 - GPO $6.00	TI85900283	MN -78	10:4694
0797-Suppl.6	NTIS, PC A12/MF A01 - GPO* $6.50	TI85900338	MN -41	10:4734
0940-Vol.3-No.3	NTIS, PC A13/MF A01 - GPO*	TI85900381	MN -2	10:4669
0979-Suppl.2	NTIS, PC A07/MF A01 - GPO* $5.50	TI85900317	MN -78	10:4735
0989-Suppl.1	NTIS, PC A03/MF A01 - GPO* $4.50	TI85900312	MN -78	10:4736
1081	NTIS, PC A03/MF A01 - GPO* $3.75	TI85900250	MN -80	10:4737
1087	NTIS, PC A14/MF A01 - GPO*	TI85900357	MN -78	10:4695
1088-App.A	NTIS, PC A22/MF A01 - GPO* $10.00	TI85900386	MN -78	10:4738
1097	NTIS, PC A20/MF A01 - GPO* $11.00	TI85900382	MN -78	10:4670
NUREG/CR-				
2000-Vol.3-No.9	NTIS, PC A06/MF A01 - GPO	TI85000596	MN -80	10:4677
3429	NTIS, PC A03/MF A01 - GPO $3.75	TI85002815	MN -70A	10:4398
3675	NTIS, PC A07/MF A01 - GPO	TI85003121	MN -79	10:4739
3691-Rev.	NTIS, PC A07/MF A01 - GPO	TI85003123	MN -78	10:4678
3715	NTIS, PC A04/MF A01 - GPO	TI85002251	MN -78	10:4624
3719-R3	NTIS, PC A04/MF A01 - GPO	TI85002955	MN -80	10:4740
3737	NTIS, PC A06/MF A01 - GPO $4.75	TI85002490	MN -80	10:4741
3891	NTIS, PC A12/MF A01 - GPO	TI85000410	MN -80	10:4679
3927	NTIS, PC A03/MF A01 - GPO	TI85000409	MN -78	10:4916
4029	NTIS, PC A04/MF A01 - GPO	TI85002517	MN -80	10:4742
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285	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85002805	MN -11	10:5292
OCS/MMS-				
84-0024	Minerals Management Service, 1340 W. 6th Street, Los Angeles, CA 90017	TI85900376	MN -92	10:4273
84-0050	OCS Information Program, 12203 Sunrise Valley Drive, Reston, VA 22091	TI85900313	MN -92	10:4289
OEFZS-				
4264	NTIS (US Sales Only), PC A03/MF A01	DE85780082	MN -4	10:4642
4281	NTIS (US Sales Only), PC A02/MF A01	DE85780090	MN -86	10:4349
OEFZS-A-				
0514	OEFZS, A-2444 Seibersdorf, Austria		ND -51	10:5397
ONERA-NT-				
1982-7	*See* N-84-27336			10:5309

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ORAU-				
233-Vol.1	NTIS, PC A06/MF A01; i (GPO Dep.)	DE85003421	MN -13	10:6233
234	NTIS, PC A08/MF A01 (GPO Dep.)	DE85003437	MN -13	10:6234
ORAU/IEA-				
83-6(M)	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85003088	MN -13	10:6235
ORNL-				
6076	NTIS, PC A07/MF A01 (GPO Dep.)	DE84017641	STD -41	10:5562
ORNL-MIT-				
66	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002584	MN -20	10:6099
ORNL-NSF-EP-				
1	NTIS			10:5390
ORNL/NSIC-				
200-Vol.3-No.9	*See* NUREG/CR-2000-Vol.3-No.9	TI85000596	MN -80	10:4677
ORNL/Sub-				
79-7778/ 3	*See* NUREG/CR-3891	TI85000410	MN -80	10:4679
80-7948/ 2	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85003190	MN -95d	10:4836
7317/ 3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85000419	MN -95f	10:4798
ORNL/TM-				
8652	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85000156	MN -41	10:5315
9135	*See* NUREG/CR-3715	TI85002251	MN -78	10:4624
9309	*See* NUREG/CR-3927	TI85000409	MN -78	10:4916
ORO-				
3948-16	*See* DOE/ER/03948-16	DE85003422	MN -34D	10:5813
OSQ-				
78-00093	NTIS (US Sales Only), PC A06/MF A01	DE85780094	MN -51	10:4399
80-00030	NTIS (US Sales Only), PC A03/MF A01	DE85780095	MN -51	10:4328
OSU-				
80-00123	NTIS (US Sales Only), PC A05/MF A01	DE85780098	MN -11	10:5413
OTA-E-				
216	GPO*	TI84901923	MN -2	10:4791
237	*See* PB-84-222413			10:4257
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4,461,018				10:5281
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4,470,848				10:4920
4,470,947				10:4758
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PB-				
84-108919	*See* BNL-tr-1037	DE85001773	MN -70	10:4401
84-169150	NTIS PC E04/MF E04			10:5456
84-200351	NTIS PC E11/MF E01			10:4311
84-203298	NTIS PC E04/MF E04			10:4917
84-203512	Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation PB-293 164, PB-249 613, PB-250 113 and PB-250 114			10:5316
84-204338	NTIS PC E06/MF E06			10:4862
84-204437	NTIS PC E04/MF E04			10:4837
84-205194	NTIS PC E04/MF E04			10:4838
84-209063	NTIS PC E05/MF E01			10:5274
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84-220177	NTIS, PC A05/MF A01			10:4255
84-220227	NTIS, PC A05/MF A01			10:5457
84-220318	NTIS, PC A06/MF A01			10:4212
84-220664	NTIS, PC A07/MF A01			10:4256
84-221134	NTIS, PC A03/MF A01			10:5279
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84-222215	NTIS, PC A03/MF A01			10:5117
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84-223098	NTIS, PC A09/MF A01			10:5400
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84-224088	NTIS PC E05/MF E01			10:5294
84-224492	NTIS, PC A03/MF A01			10:4326
84-225101	NTIS, PC A10/MF A01			10:4810
84-225184	NTIS, PC A03/MF A01			10:4258
84-225325	Pub. in Proceedings of Conf. Nuclear Data Science Technology, Antwerp, Belgium, September 6-10, 1982, p971-973 1983			10:5651
84-225903	NTIS, PC A02/MF A01			10:4259
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84-229749	NTIS, PC A04/MF A01			10:5118
84-230036	NTIS, PC A05/MF A01			10:4179
84-230358	NTIS, PC A06/MF A01			10:5552
84-231208	NTIS PC E03/MF E01			10:4278
84-231448	NTIS, PC A11/MF A01			10:5119
84-232305	NTIS PC E04/MF E04			10:4374
84-232487	NTIS, PC A10/MF A01			10:5068
84-232503	NTIS, PC A07/MF A01			10:5120
84-232545	NTIS, PC A05/MF A01			10:5403
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84-232875	NTIS, PC A16/MF A01			10:4395
84-232982	NTIS PC E07/MF E07			10:4375
84-233006	NTIS PC E05/MF E05			10:5350
84-233238	NTIS PC $18.00			10:4180
84-233493	NTIS PC E05/MF E05			10:5414
84-233592	NTIS PC E03/MF E03			10:5317
84-234848	NTIS PC E04/MF E01			10:4743
84-235282	NTIS, PC A02/MF A01			10:4260
84-235381	NTIS PC E08/MF E08			10:5458
84-235399	NTIS PC E04/MF E04			10:4588
84-235688	NTIS, PC A04/MF A01			10:4297
84-235779	NTIS, PC A06/MF A01			10:4418
84-236249	NTIS PC E04/MF E04			10:5515
84-236603	NTIS, PC A05/MF A01			10:5553
84-236710	NTIS, PC A07/MF A01			10:4213
84-237742	NTIS, PC A03/MF A01			10:4181
84-237759	NTIS, PC A06/MF A01			10:4182
84-237775	NTIS, PC A04/MF A01			10:4419
84-237783	NTIS, PC A08/MF A01			10:4194
84-237809	NTIS, PC A04/MF A01			10:4305
84-237833	NTIS, PC A99/MF A01			10:5355
84-239151	NTIS, PC A09/MF A01			10:4261
84-241637	NTIS, PC A02/MF A01			10:5318
84-241793	NTIS, PC A02/MF A01			10:5319
84-241892	NTIS, PC A02/MF A01			10:5320
84-242049	NTIS, PC A02/MF A01			10:5321
84-242569	NTIS, PC A02/MF A01			10:5392
84-242577	NTIS, PC A03/MF A01			10:5322
84-243039	NTIS, PC A02/MF A01			10:5323
84-243179	NTIS, PC A02/MF A01			10:5324
84-246446	NTIS, PC A06/MF A01			10:5404
84-900601	*See* DOE/EFB-84/1	DE84016468	STD -61	10:4452
166081	NTIS, PC A02; 3	TI84901913	MN -90a	10:4183
166815	NTIS, PC A02; 3	TI84901912	MN -90a	10:4266
PHL-				
1983-47	*See* N-84-27344			10:4290
PNC-J-				
265-82-01	NTIS (US Sales Only), PC A05/MF A01	DE84703280	MN -80	10:4704
PNC-N-				
930-81-03	NTIS (US Sales Only), PC A04/MF A01	DE84703294	MN -79	10:4705
PNCT-N-				
941-83-15	NTIS (US Sales Only), PC A02/MF A01	DE84703295	MN -79	10:4659
952-82-13	NTIS (US Sales Only), PC A05/MF A01	DE84703310	MN -32	10:4676
PNL-				
5094	*See* NUREG/CR-3429	TI85002815	MN -70A	10:4398
5102	*See* NUREG/CR-3737	TI85002490	MN -80	10:4741
5137	NTIS, PC A07/MF A01; 1 (GPO Dep.)	DE84014890	MN -80	10:4744
PNL-SA-				
11270	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003112	MN -25	10:4918
11785	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003111	MN -41	10:5516
12038	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000832	MN -80	10:4745
12135	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003104	MN -95d	10:4840
12212	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003107	MN -34A	10:5652
12283	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002539	MN -70	10:4379
12330	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002541	MN -32	10:6249
12397	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000367	MN -80	10:4746
12466	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002536	MN -41	10:5517
12475	NTIS (US Sales Only), PC A02/MF A01 (GPO Dep.)	DE85003117	MN -78	10:4680
12538	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002525	MN -70B	10:4396

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12573	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003116	MN -34A	10:4970
12576	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003115	MN -85	10:4354
12594	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003118	MN -34A	10:5088
PP-				
127	*See* N-84-28264			10:4597
132	*See* N-84-28206			10:4767
PTB-Dos-				
9	NTIS (US Sales Only), PC A03/MF A01	DE85750008	MN -41	10:5459
R-				
623-D/ EMV83-31	ECN, P.O. Box 1, 1755 ZG Petten, Netherlands		ND -60	10:4598
8403	*See* AD-A-144610/3			10:5588
RAL-				
83-117	*See* RL-83-117	DE85700062	MN -34A	10:5675
83-118	*See* RL-83-118	DE85700048	MN -34A	10:5980
84-002	NTIS (US Sales Only), PC A02/MF A01	DE85700071	MN -34D	10:5730
84-004	NTIS (US Sales Only), PC A03/MF A01	DE85700059	MN -34B	10:5634
84-005	NTIS (US Sales Only), PC A05/MF A01	DE85700058	MN -34B	10:5635
84-010	*See* PB-84-205194			10:4838
84-015	NTIS (US Sales Only), PC A02/MF A01	DE84703270	MN -28	10:5170
84-027	NTIS (US Sales Only), PC A02/MF A01	DE85700035	MN -34A	10:5653
84-028	NTIS (US Sales Only), PC A02/MF A01	DE84703379	MN -34C	10:5941
84-029	NTIS (US Sales Only), PC A02/MF A01	DE84703380	MN -34C	10:5942
84-030	NTIS (US Sales Only), PC A02/MF A01	DE85700046	MN -34A	10:5979
84-031	NTIS (US Sales Only), PC A03/MF A01	DE84703273	MN -28	10:5171
84-033	NTIS (US Sales Only), PC A02/MF A01	DE84703353	MN -34D	10:5731
84-038	NTIS (US Sales Only), PC A02/MF A01	DE84703381	MN -34C	10:5943
84-039	NTIS (US Sales Only), PC A03/MF A01	DE85700073	MN -34D	10:5695
84-042	NTIS (US Sales Only), PC A02/MF A01	DE85700031	MN -34D	10:5768
84-047	NTIS (US Sales Only), PC A03/MF A01	DE85700047	MN -34A	10:4994
REG/G-				
1.147	NTIS, PC A02/MF A01 - GPO	TI84900274	MN -78	10:4671
10.6-Rev.2	NTIS, PC A03/MF A01	TI85900296	MN -41	10:5107
10.9	NTIS, PC A02/MF A01 - GPO*	TI85900189	MN -2	10:4407
RERF-TR-				
6-81	NTIS (US Sales Only), PC A03/MF A01	DE84703255	MN -48	10:5518
18-81	NTIS (US Sales Only), PC A02/MF A01	DE84703254	MN -48	10:5519
26-81	NTIS (US Sales Only), PC A03/MF A01	DE84703262	MN -41	10:5520
RHO-BW-SR-				
84-1-1Q-P	NTIS, PC A04/MF A01 (GPO Dep.)	DE85003171	MN -70	10:4380
Rijnhuizen-				
84-151	NTIS (US Sales Only), PC A03/MF A01	DE85700155	MN -20	10:6039
84-152	NTIS (US Sales Only), PC A03/MF A01	DE85700157	MN -20	10:6040
RISLEY-Trans-				
4152	NTIS (US Sales Only), PC A03/MF A01; 1	DE84901839	MN -80	10:4759
RISO-M-				
2397	NTIS (US Sales Only), PC A04/MF A01	DE85700050	MN -20	10:6041
RL-				
83-099	NTIS (US Sales Only), PC A02/MF A01	DE85700067	MN -34D	10:5732
83/ 113	*See* PB-84-169150			10:5456
83-117	NTIS (US Sales Only), PC A03/MF A01	DE85700062	MN -34A	10:5675
83-118	NTIS (US Sales Only), PC A03/MF A01	DE85700048	MN -34A	10:5980
83-126	NTIS (US Sales Only), PC A02/MF A01	DE85700068	MN -34D	10:5733
RR-				
1725	*See* BHRA-84/41			10:4439
SA-				
83-12	*See* RAL-84-005	DE85700058	MN -34B	10:5635
83-20	*See* RAL-84-004	DE85700059	MN -34B	10:5634
SAAS-				
312	NTIS (US Sales Only), PC A03/MF A01	DE85780205	MN -41	10:5521
313	NTIS (US Sales Only), PC A04/MF A01	DE85780222	MN -70	10:4381
SAIC-				
84-1341-PRI-82	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002658	STD -20g	10:6100
84/ 1355/ PRI-83	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002659	STD -20g	10:6042
84/ 1787/ PRI-84	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003049	STD -20g	10:6043
SAND-				
81-1726	*See* NUREG/CR-3675	TI85003121	MN -79	10:4739
82-2393C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002633	MN -20	10:6101
82-8177-Vol.1	NTIS, PC A09/MF A01; 1	DE85003020	MN -62d	10:4503
82-8177-Vol.2-App.	NTIS, PC A14/MF A01; 1 (GPO Dep.)	DE85003021	MN -62d	10:4504
82-8178-Vol.1	NTIS, PC A15/MF A01; 1 (GPO Dep.)	DE85002669	MN -62d	10:4505
82-8178-Vol.2	NTIS, PC A20; 3	DE85002668	MN -62d	10:4506
83-2372C	NTIS, PC A02; 3	DE84006292	MN -70	10:4919
83-2624-R3	*See* NUREG/CR-3719-R3	TI85002955	MN -80	10:4740
83-2625	NTIS, PC A19/MF A01; 1 (GPO Dep.)	DE84015938	MN -70	10:5591
83-7040/ 1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85002312	MN -63	10:4473
83-8175	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85002954	MN -62d	10:4444
83-8176	NTIS, PC A05/MF A01; 1 (GPO Dep.)	DE85003196	MN -62d	10:4445
84-0422-Rev.	*See* NUREG/CR-3691-Rev.	TI85003123	MN -78	10:4678
84-0985C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000467	MN -22	10:4331
84-1099	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003161	STD -32	10:5955
84-1423C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002639	MN -28	10:5139
84-1627C	NTIS, PC A02; 3	DE84016780	MN -80	10:4747
84-1764C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002441	MN -78	10:4748
84-1768C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002446	MN -78	10:4749

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84-1801C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000771	MN -78	10:4750
84-1837C	NTIS, PC A02; 3	DE84017005	MN -78	10:4751
84-1979C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000769	MN -80	10:4752
84-2017C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002445	MN -60	10:4599
84-2060C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002624	MN -70	10:4382
84-2076C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002643	MN -78	10:4753
84-2077C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002641	MN -78	10:4754
84-2208C	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000415	MN -38	10:5079
84-7011	NTIS, PC A12/MF A01; 1 (GPO Dep.)	DE85002787	STD -62	10:4578
84-8014	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002589	MN -37	10:5280
84-8181	NTIS, PC A04/MF A01 (GPO Dep.)	DE85003154	MN -62d	10:4507
84-8237	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002863	MN -62c	10:4508
SC-				
171	*See* AD-A-953431/4			10:4148
SERI/PR-				
255-2162	NTIS, PC A03/MF A01	DE84013050	MN -59a	10:4579
SERI/SP-				
271-2502	NTIS, PC A02/MF A01 (GPO Dep.)	DE84013042	STD -63	10:4474
SERI/STR-				
211-2412	NTIS, PC A08/MF A01; 1 (GPO Dep.)	DE85000501	STD -63	10:4475
211-2451	NTIS, PC A06/MF A01; 1 (GPO Dep.)	DE85000507	STD -63	10:4476
SERI/TP-				
214-2374	NTIS, PC A02; 3	DE84013012	MN -60	10:4600
231-2483	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000506	STD -61a	10:4811
252-2337	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE84013026	STD -62	10:4509
253-2461	NTIS, PC A02/MF A01; 1	DE85000526	MN -59b	10:4841
253-2465	NTIS, PC A02; 3	TI84013041	MN -59b	10:4545
253-2476	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85000527	MN -59b	10:4546
253-2485	NTIS, PC A02; 3 (GPO Dep.)	DE84013044	MN -59b	10:4842
255-2454	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000512	STD -59b	10:4843
255-2455	NTIS, PC A02/MF A01 (GPO Dep.)	DE85000513	STD -59b	10:4547
SERI/TR-				
252-2464	NTIS, PC A04/MF A01 (GPO Dep.)	DE85000510	STD -62	10:4548
SERP-E-				
77	*See* IFVE-OEIPK-83-43	DE84703362	MN -34D	10:5685
133	*See* IFVE-OEIPK-83-152	DE84703361	MN -34D	10:5688
138	*See* IFVE-OEIPK-83-97	DE84703363	MN -34D	10:5686
SFB-				
80/ T/ 216	NTIS (US Sales Only), PC A03/MF A01; 1	DE84752269	MN -38	10:5101
SGD-				
476-PT-2	*See* PB-84-215078			10:5633
SLAC-				
273	NTIS, PC A17/MF A01; 1 (GPO Dep.)	DE85003057	STD -28	10:5265
SLAC/AP-				
31	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85002588	MN -34A	10:5995
SLAC-PUB-				
3406	NTIS, PC A02; 3	DE84017639	MN -34D	10:5734
3440	NTIS, PC A02; 3	DE85002717	MN -34D	10:5735
3446	NTIS, PC A02/MF A01 (GPO Dep.)	DE85001941	MN -34D	10:5696
3462	NTIS, PC A02; 3	DE85002685	MN -28	10:5266
3464	NTIS, PC A02; 3	DE85002686	MN -28	10:5267
3468	NTIS, PC A02; 3	DE85002687	MN -28	10:5268
SLU-LBT-				
35	NTIS (US Sales Only), PC A06/MF A01; 1	DE85750229	MN -59b	10:4852
1983-32	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750219	MN -59a	10:4853
1983-33	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750220	MN -59a	10:4854
1983-34	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750221	MN -95	10:4855
SNS-				
0-N1-84	*See* RAL-84-031	DE84703273	MN -28	10:5171
SNV-PM-				
1628	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750217	MN -11	10:5325
SOU-				
1983-19	NTIS (US Sales Only), PC A15/MF A01	DE85750218	MN -98	10:4779
SRD-R-				
238	UKAEA, Wigshaw Lane, Culcheth Warrington, WA3 4NE, England	TI85900242	ND -41	10:5111
245	UKAEA-Safety and Reliability Directorate, Culcheth, Warrington, WA3 4NE, England 5.00 pou	TI85900243	ND -38	10:5074
291	UKAEA, Safety and Reliability Directorate Culcheth Warrington, WA3 4NE, England	TI85900246	ND -92	10:5080
299	UKAEA, Wigshaw Lane, Culcheth Warrington, WA3 4NE, England	TI85900203	ND -41	10:5563
SRO-				
870-1-App.	*See* DOE/SR/00870-1-App.	DE85002210	MN -61	10:5470
ST-				
120/ 84	*See* OEFZS-A-0514		ND -51	10:5397
STU-				
80-5604	NTIS (US Sales Only), PC A03/MF A01	DE85750226	MN -59a	10:4580
82-4174	*See* STUDSVIK-EI-83-155	DE85750225	MN -92a	10:4313
STUDSVIK-EI-				
83-155	NTIS (US Sales Only), PC A03/MF A01; 1	DE85750225	MN -92a	10:4313
SUNI-				
66	NTIS (US Sales Only), PC A03/MF A01	DE84703318	MN -2	10:5121

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SVF-				
148	NTIS (US Sales Only), PC A02/MF A01; 1	DE85750208	MN -38	10:5115
149	NTIS (US Sales Only), PC A04/MF A01; 1	DE85750209	MN -11	10:4303
150	NTIS (US Sales Only), PC A02/MF A01; 1	DE85750210	MN -90	10:4195
T-				
341	*See* RAL-84-028	DE84703379	MN -34C	10:5941
342	*See* RAL-84-029	DE84703380	MN -34C	10:5942
TAUP-				
151-83	*See* DOE/ER/03992-564	DE85001836	MN -34D	10:5753
N153-84	*See* DOE/ER/03992-566	DE85001834	MN -34D	10:5755
TDCK-				
78759	*See* N-84-27344			10:4290
TF-				
212	*See* PB-84-233006			10:5350
TM-				
63-6-702	NTIS, PC A04; 3	DE84017124	MN -80	10:4706
TNO-HMT-				
83-0317	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Zeist, Netherlands			10:4196
83-0454	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Zeist, Netherlands			10:4197
83-01613	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4207
83-01620	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4208
83-08424	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4184
TNO-KRI-				
145/ 83	Nijverheidsorganisatie TNO, Hoofdgroep Maatschappelijke Technologie, Delft, Netherlands			10:4209
278/ 83	Nijverheidsorganisatie TNO, Kunstoffen en Rubber Inst., Delft, Netherlands			10:4185
TR-				
2	*See* AD-A-142797/0			10:5082
14	*See* AD-A-143202/0			10:4960
Trans-WH-				
572	NTIS (US Sales Only), PC A02; 3	DE84900834	MN -78	10:4637
TRI-PP-				
83-51	NTIS (US Sales Only), PC A02/MF A01	DE85700036	MN -34A	10:5654
83-52	NTIS (US Sales Only), PC A02/MF A01	DE85700037	MN -34A	10:5655
83-53	NTIS (US Sales Only), PC A02/MF A01	DE85700038	MN -34A	10:5656
83-54	NTIS (US Sales Only), PC A02/MF A01	DE85700039	MN -34A	10:5657
83-55	NTIS (US Sales Only), PC A03/MF A01	DE85700012	MN -34D	10:5996
83-56	NTIS (US Sales Only), PC A02/MF A01	DE85700074	MN -34D	10:5697
83-57	NTIS (US Sales Only), PC A02/MF A01	DE85700069	MN -34D	10:5736
83-58	NTIS (US Sales Only), PC A02/MF A01	DE85700040	MN -34A	10:5658
83-59	NTIS (US Sales Only), PC A02/MF A01	DE85700041	MN -34A	10:5659
83-60	NTIS (US Sales Only), PC A02/MF A01	DE85700042	MN -34A	10:5660
83-61	NTIS (US Sales Only), PC A02/MF A01	DE85700072	MN -34D	10:5698
84-41	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900218	MN -34	10:5769
84-47	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900225	MN -34D	10:5140
84-51	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900295	MN -34A	10:5661
84-52	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900294	MN -34A	10:5662
84-55	NTIS (US Sales Only), PC A02/MF A01; 1	DE85900291	MN -34C	10:5825
84-59	NTIS (US Sales Only), PC A02/MF A01	DE85900290	MN -34D	10:5848
TRW-				
39364-6006-UT-00	*See* AD-A-144171/6			10:4295
TT-				
8403	*See* N-84-28095			10:4868
TUM-M-				
8310	Library of Technische Univ. Muenchen (Germany, F.R.)			10:4549
TVA/ONRED/EQS-				
84/ 1	NTIS, PC A02/MF A01	DE85900231	MN -11	10:4788
TVA/PUB-				
84/ 81	NTIS, PC A05/MF A01; 1	DE85900241	MN -90i	10:4214
84/ 82	NTIS, PC A06/MF A01; 1	DE85900240	MN -97e	10:4761
UCID-				
20166-Vol.3	NTIS, PC A03/MF A01 (GPO Dep.)	DE85002575	MN -20	10:6102
20179	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003055	MN -33	10:5284
20189	NTIS, PC A10/MF A01; 1 (GPO Dep.)	DE85002962	MN -22	10:4332
20196	NTIS, PC A04/MF A01; 1 (GPO Dep.)	DE85002958	MN -22	10:4333
20247	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE85002808	MN -11	10:4755
30200-83-4	NTIS, PC A02/MF A01 (GPO Dep.)	DE85002644	MN -32	10:5075
30206	NTIS PC E04/MF A01; 1 (GPO Dep.)	DE85002690	MN -70	10:4383
UCLA-				
12/ 1464	NTIS, PC A03/MF A01 (GPO Dep.)	DE85003562	STD -11	10:4447
1260	NTIS, PC A05/MF A01 (GPO Dep.)	DE85002518	MN -48	10:5434
UCRL-				
15419-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85001055	MN -41	10:5269
50007-83	NTIS, PC A05/MF A01 (GPO Dep.)	DE85001434	STD -41	10:5564
52000-84-5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	DE84013578	STD -2	10:5435
53524	NTIS, PC A04/MF A01 (GPO Dep.)	DE85003159	STD -11	10:5522
53552	NTIS, PC A04/MF A01 (GPO Dep.)	DE85003157	STD -70	10:5604

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88409	NTIS, PC A03; 3	DE85001053	MN -38	10:4615
90603	NTIS, PC A03/MF A01 (GPO Dep.)	DE85001210	MN -45	10:5285
91040	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003137	MN -28	10:5128
91041	NTIS, PC A02/MF A01 (GPO Dep.)	DE85003138	MN -28	10:5172
91268	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003140	MN -11	10:5293
91421	NTIS, PC A02/MF A01; 1 (GPO Dep.)	DE85003200	MN -34C	10:5944
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RA Report analytic
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BA Book analytic
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D Thesis or dissertation
TG Translation (general)
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TH Thailand
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TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
ZM Zambia
ZR Zaire

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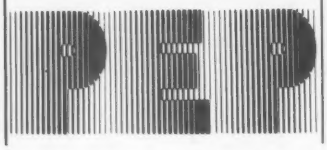

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